February 1984 Volume 2 $2.50

softalk

for the IBM Personal Computer

TALE OF THE PORTS

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It Paints in 3-D, Keeps
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Spread Sheet
Graphics
Word Processing
Communication
Time Management

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1

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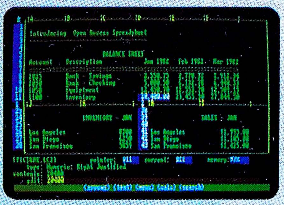
2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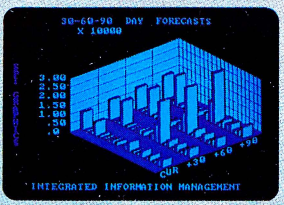
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Word Processing
Time Management

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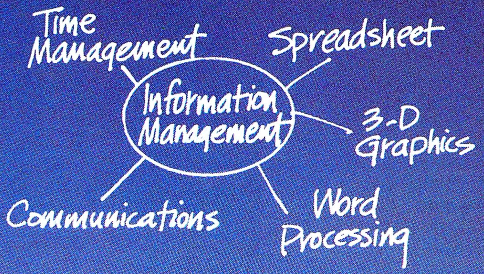
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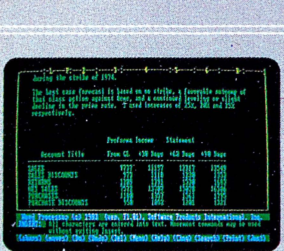

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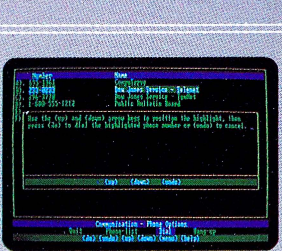
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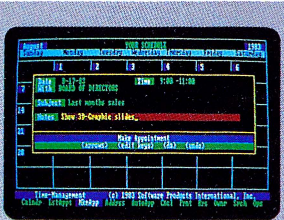
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for the IBM Personal Computer

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A Manufacturing System for the PC

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The PC Provides Patient Care

Microcomputers have been cropping up all over Southfield, Michigan's Sinai Hospital. Nearly all are PCs, and their presence is due largely to the efforts of obstetrician/gynecologist Edward M. Lichten.

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Tale of the Ports

The PC has a limited number of input/output ports for use by optional expansion devices, and these ports are rapidly being used up by IBM and other vendors.

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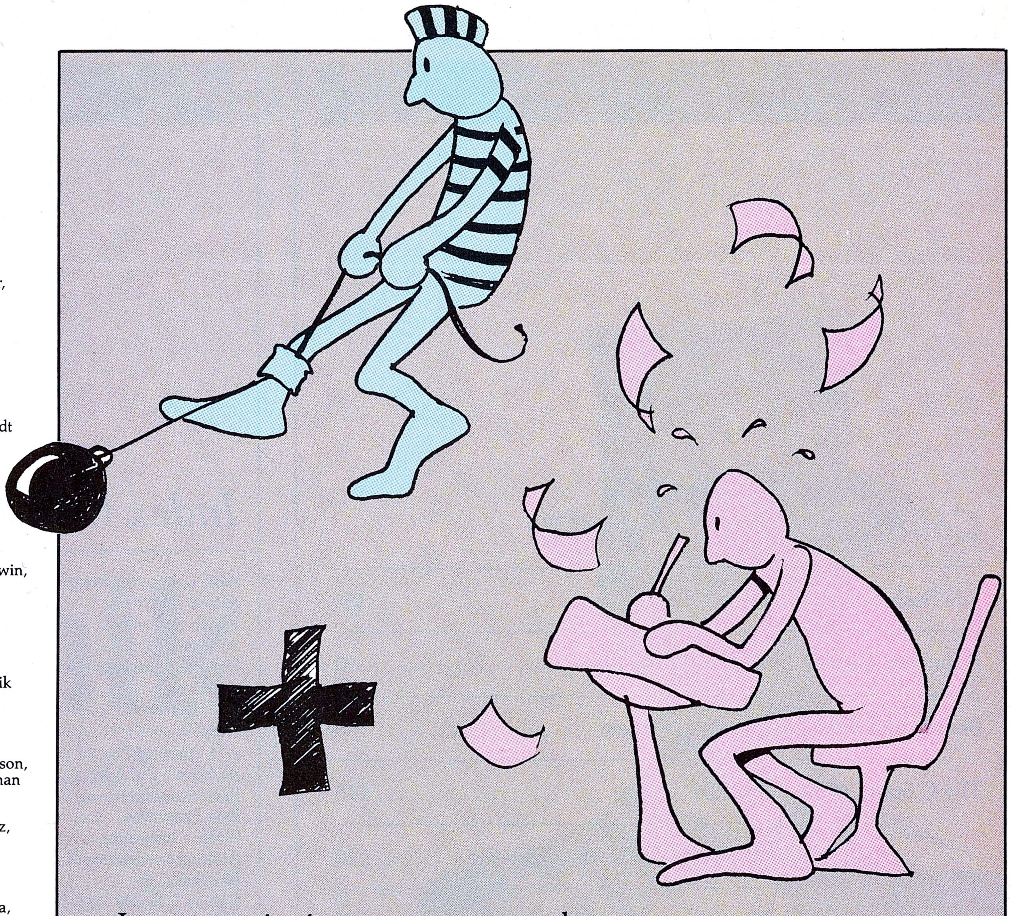

In our continuing quest to prove that computers are not necessarily smarter than most humans, we are giving you the opportunity to fool our spelling checker. We all know that even the Cray 100 can't distinguish between homonyms (pairs of words that have the same sound but different meanings).

Sew, inn won hun dread udder aunts says ore phew err, sea watt ewe Cannes right witch hour spelling checker cant marc as ink erect. Bee humerus may bee. Bee Sirius. Bee awl ewe Cannes bee.

P.S. Send your entry by the first of March—along with your name, address, phone, name of nearest dealer, and what you want if you win (chosen from the products of this issue's advertisers)—to Pea Sea Con Test, Softalk IBM, Box 7040, North Hollywood, CA 91605. ▲

WINNERS

The outpouring of response to Crypto Kitchen nearly did in our random number generator; however, it rose to the challenge and panted out *11*, the entry of Birmingham, Alabama's own Delicia Dozier.

The random number generator (RND for short) wants to thank everyone who entered, nearly all of whom got the crypto alphabet correct. RND would like to admonish those who stuffed the ballot box but notes that it did not disqualify those who did so—just their other eighteen entries. Honorable mention for stuffing efforts go to the cities of Binghamton, New York, and Philadelphia, Pennsylvania. RND is grateful to those who sent *it* puzzles but regrets that the only numbers it can produce will not solve the ciphers. ▲

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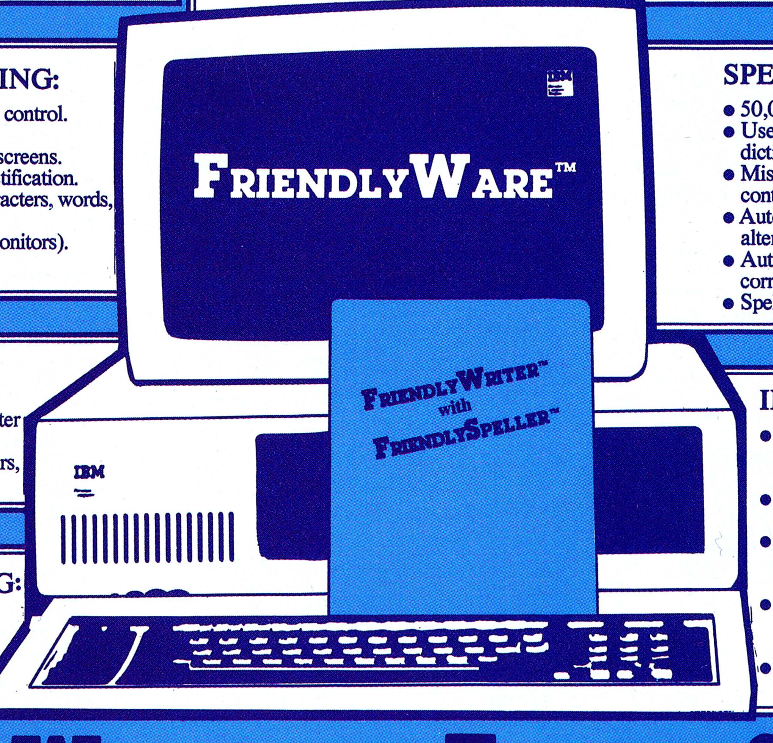

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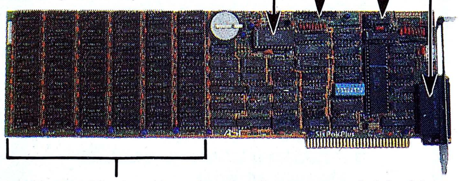
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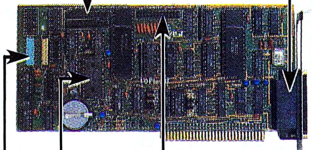
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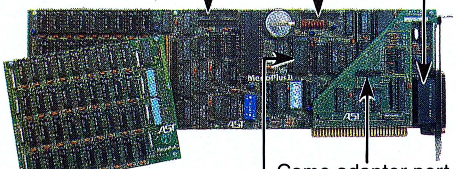
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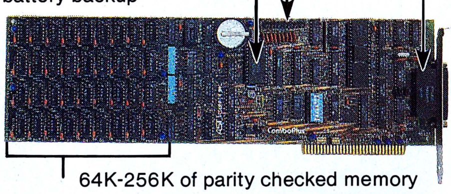
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Parallel printer port
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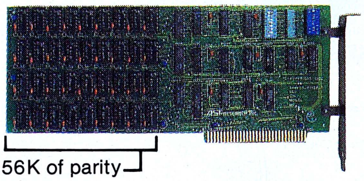

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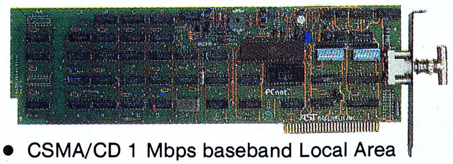

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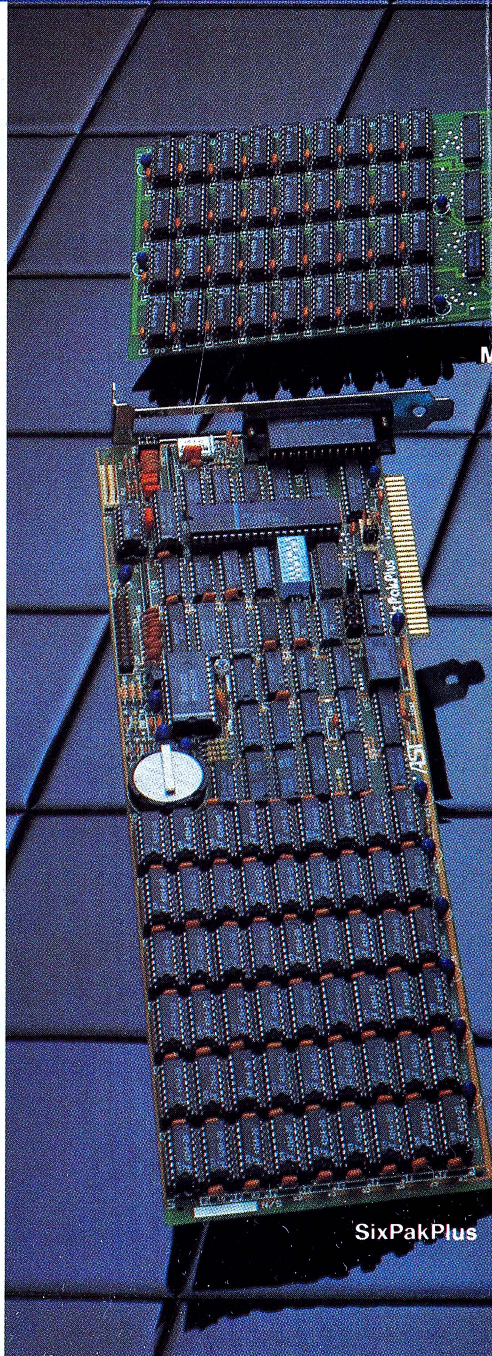

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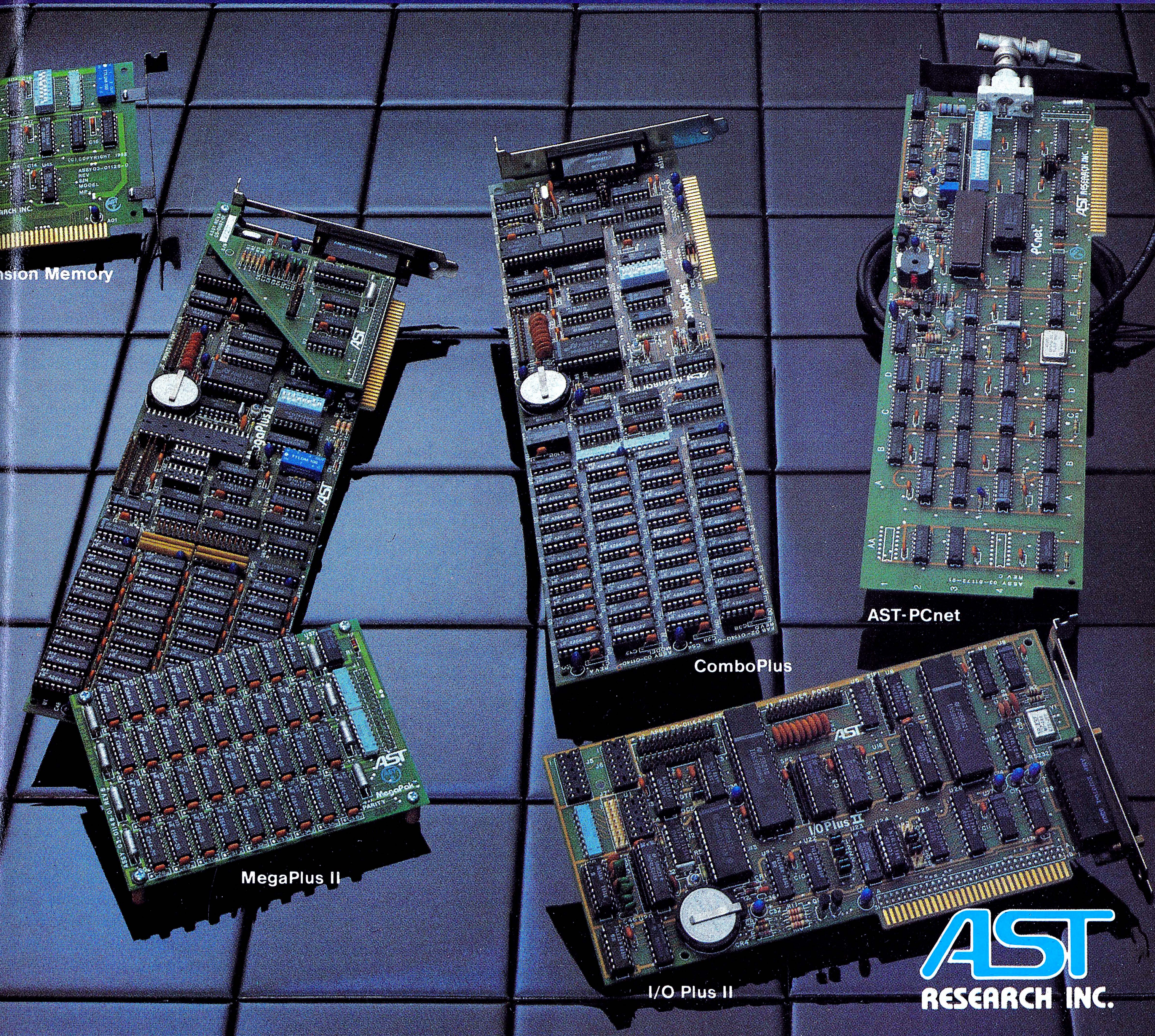

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crosstalk

Can Scrnsave Be Saved?

I read the article "Save Your Monitor Screen!" (John Socha, December 1983) and was so enthusiastic about it that I immediately typed in the Basic program, created the com file, and incorporated it into my Autoexec.bat file.

However, I think Scrnsave could stand one improvement: Provide the user with a way to vary the time interval from the given three-minute period; for example, sometimes I'd like a longer interval, such as five minutes.

The best way would be for Scrnsave.com to ask the user for the desired time interval or have the parameter passed on the command line. The alternative would be to modify a data statement in the Basic generating program.

Michael Shunfenthal, Torrance, CA

Surely some enterprising Basic adept has already modified Scrnsave. We, and all the readers who have telephoned and written us about Scrnsave, would be very grateful if you would share your knowledge with us.

Typos in Programs

It has been my pleasure to receive the first year of my subscription to *Softalk* for free, and when the renewal notice arrived, I hesitated only momentarily before sending in my check. You have consistently provided valuable and timely information without trying to be everything to everybody.

Some of your most helpful features have been your program listings, such as the Basic cross-referencer (February 1983) and the screensave program (December 1983), which not only have been useful but also have certainly honed my touch-typing skills on the numeric and special characters!

There is, however, one practice of yours that makes little sense to me. It seems that you typeset the program listings, rather than simply reproducing listings made by the programs' authors. While this may make for more attractive copy, it also invites typographical errors that are catastrophic in computer programs. As an experienced professional programmer, I am able to catch some of them, but at other times there are ambiguities that are evident only in the context of the program's logic. In any case, life is made more difficult than necessary.

I, for one, would not be offended by seeing reproductions of actual program listings. It would give me confidence that what I see is what I get, and might save me considerable debugging time. It takes me long enough to sift out my own typing errors—I don't need yours too!

In general, thanks for a great magazine.

Tom Eagan, Eastsound, WA

We're now generating typeset copy directly from authors' disk files, so you shouldn't be finding any more typographical errors in our programs. There's still plenty of room, however, for touch-typing quirks and human error; see John Socha's apologia, "Of Bugs and Men," in the January 1984 issue.

Rounding Error

I would like to thank John van Laer for his letter ("Crosstalk," December 1983) pointing out a problem with the even rounding routine in my article "How To Get 'Round the Rounding Bug" (August 1983). This problem existed in the original pocket calculator algorithm from which I adapted the routine. I am sorry I didn't catch the problem before using the algorithm and must apologize for any inconvenience this may have caused anyone.

The main problem with the FnErnd function is that it is *not* a complete rounding function as advertised; instead, it is a clever way to drop the decimal and go to the nearest even dollar amount. However, it should only be used after the decimals have been determined to be exactly 50 by some other means. The following Basic routine is a way of using FnErnd correctly:

```
100 DEF FNDRND#(G#,K)=
    INT((G#*10∧K)+.5)/10∧K
110 DEF FNERND#(G#,K)=
    INT(((G#/2)*10∧K)+.5)*2/10∧K
 ***
1000 ' EVEN ROUNDING ROUTINE #1
1010 G2#=G#*10∧K-INT(G#*10∧K)
1020 IF G2#⟨⟩.5 THEN 1040
1030 G1#=FNERND#(G#,K) : RETURN
1040 G1#-FNDRND#(G#,K) : RETURN
```

To use even rounding, execute *gosub 1000* with G# equal to the number to be rounded and K equal to the number of digits desired to the right of the decimal. On returning from the routine, G1# holds the rounded value.

In checking the performance of the rounding routines, one soon notes apparent failures to follow the desired rounding rules that are attributable to the way Basic represents decimal fractions and to the fact that Basic computes 10∧K in single precision. For example, if you ask Basic to print 10∧11, it prints 1E+11

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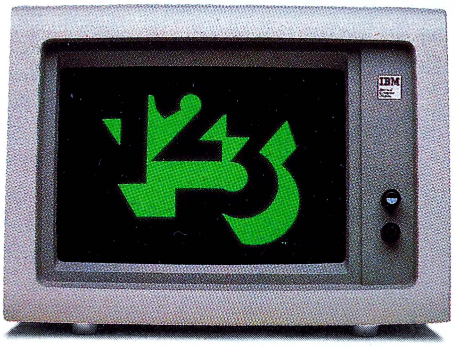

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as expected, but if you execute the following in direct mode:

```
X#=.55555555555# : PRINT X#*10∧11
```

Basic prints 55555554417.22222. The performance of the rounding routines when rounding to five or more places to the right of the decimal or on numbers with a large number of significant figures can be improved by using the new routines below:

```
100 DEF FNDRND#(G#,K1#)=
     INT((G#*K1#)+.5#)/K1#
110 DEF FNERND# (G#,K1#)=
     INT(((G#/2)*K1#)+.5#)*2/K1#
***
1000 ' EVEN ROUNDING ROUTINE #2
1010 G2#=G#*K1#-INT(G#*K1#)
1020 IF G2#<.4999# OR G2#>.5001#
      THEN 1040
1030 G1#=FNERND#(G#,K1#) : RETURN
1040 G1#=FNDRND#(G#,K1#) : RETURN
1100 ' ROUTINE TO COMPUTE K1#
1110 K1#=1 : FOR I=1 TO K :
     K1#=K1#*10# : NEXT
1120 RETURN
```

After K has been defined, and before executing either FnDrnd or *gosub 1000*, *gosub 1100* must be executed to compute K1# more accurately than just using 10∧K.

The other improvement in these routines is the change in the *if* statement in line 1020 so that it uses FnErnd if G2# is in the range of .4999# to .5001# instead of requiring it to be exactly .5. This eliminates many of the cases in which the even rounding routine fails because of the way Basic represents decimal fractions. Some purists may object to this change, but even if the change in line 1020 is not adopted, using this routine still gives significant improvement in both ordinary rounding and even rounding. The change to line 1020 is justified because of the way our binary number system handles decimal fractions. Fractions that would end in exactly five followed by all zeros if they had been computed on a machine using the decimal number system often come out as four followed by a string of nines and other digits, or five followed by several zeros and other digits in our binary number system computer. Programmers have to decide if they want to allow for this or not. Another fact that must be remembered is that double-precision numbers in Basic are carried internally to at least seventeen digits of precision, but are rounded to sixteen digits for printing, so the number you see printed is often slightly different from the number being operated on in the program.

The performance of these routines is influenced by the particular digits in the number being rounded, so it is difficult to make a flat statement of the range over which they work. As a rough estimate, I would say that they will work as expected most of the time when the total number of significant figures is less than fifteen and when the number being rounded has twelve or fewer digits to the right of the decimal. They should fail gracefully when they do fail; that is, the point at which they go from truncation to rounding up shifts just slightly from the value of one-half the least retained digit rather than just going completely off on a tangent. Since the definition of correct rounding is somewhat fuzzy, I feel that this performance is as good as one can reasonably ask of rounding routines.

Bernard H. Robinson, Jr., Apopka, FL

Tutoring *Math Tutor*

I received the disk for the *Math Tutor* program some weeks ago, and my son uses it quite a bit. I feel that it is a valuable aid to his learning. However, I wish that there was just a little bit more documentation!

When using the test mode, there is an instruction at the end to enter a code. I cannot find directions for a code anywhere, and have tried entering all sorts of things, and even different commands. It seems that at this point one is stuck in the program, and that the only way to progress is to exit to system and boot the disk all over again! It doesn't seem right! Can you help?

John W. Pearson, Honolulu, HI

The code you need is alt-123, which you achieve by holding down the alt key, typing 123 on the numeric keypad, then releasing the alt key. Included on the Math Tutor *disk is a file named Read.me, which contains directions for this code and other aspects of* Math Tutor. *For those of you who want to brush up on your math, the program, featured in the July 1983* Softalk, *is still available for $8—with documentation.*

Disk Handler

Howard Glosser's article, "Disk Handler" (October 1983), demonstrates an interesting technique in using a short assembly routine called from Basic. Unfortunately, Mr. Glosser is well wide of the target in the fundamental assumption on which his whole article is based, which is that there is no way to determine or change the current default drive from inside Basic.

The default drive *can* easily be ascertained from Basic, and it can also be changed by using a *peek* or *poke* to the address shown below. I did not originate this information; rather, it has appeared in several user group newsletters.

```
10 DEF SEG = &HBF
20 PEEK (&H155C)
```

The *peek* will return a 0 if drive A is the current default, a 1 for drive B, and a 2 for drive C. To change the default, just *poke* the appropriate value into the address. I have used the *peek* in my own programs, so I know it works; but I should mention a couple of cautions for other users as well.

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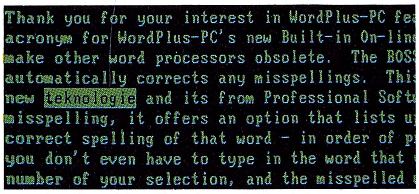

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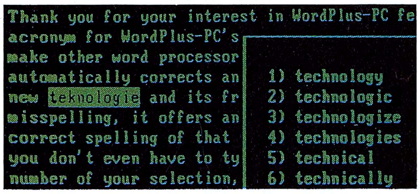

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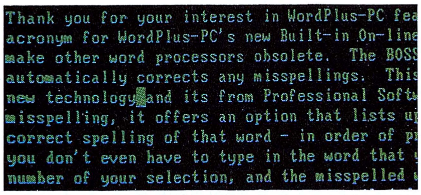

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Ibmdos.com, so proceed with care in poking around into that area of memory; peeking of course can't do any damage. Second, the address shown is for DOS 1.1; it is almost certainly different for DOS 2.0. Third, I have not had an opportunity to use the *poke* to set a default drive for a program that does a lot of field I/O, so I would encourage anyone who wants to use the *poke* to use a backup copy of their files for the experiment. Nearby addresses contain the in-memory copy of the default drive directory and file allocation table, so there is a possibility that just changing the drive with a *poke* could result in a scrambled directory and/or FAT on the disk if there is file I/O to be done.

Ralph Keuler, Seattle, WA

Thanks for your comments on Disk Handler *and the additional information you've provided. While the* peek *and* poke *to find/change the default drive will indeed work, there are some things to consider when using this particular approach.*

First, as you stated, this will only work with DOS 1.1. With each new DOS release the corresponding address will have to be researched and inserted into the Basic program along with logic to determine the version of DOS being used. This, as you may have guessed, gets rather cumbersome, as multiple versions of DOS are in use. On the other hand, Disk Handler *uses recognized IBM function calls; thus, the program should work with any subsequent release of DOS.*

Second, consider what will happen if an invalid drive value is accidentally poked into address &H155C (something other than the value 0, 1, 2, or what have you). In this case the system will default to the A drive for all disk I/O. However, when you leave Basic, the system will display the ASCII character for the value poked into that address (whether it is a valid drive letter or not) as the drive prompt. This could result, for example, in an erroneous W> prompt. To safely use this poke *address to change the default drive, it would be necessary to know what drives are available on the system and then check to make sure the value to be poked fell within this category.*

Howard Glosser, Medford, OR

Keyboard Buffer + *Easy Writer II*

Three cheers for John Socha! He has done it again. The enhanced keyboard buffer ranks with his scroll lock utility and the color/monochrome switch as three of the five commands placed in every one of my Autoexec.bat files.

One very interesting use of the keyboard buffer is with *Easy Writer II*. There are times when I need to skim through a long document looking for a particular paragraph. *EW-2* is page-oriented, and I can go to the next page with a single keystroke while in page mode. By holding down the F10 key I could thumb through my whole document, but until Socha's enhanced keyboard buffer came along, I was never able to halt the process when I came to the appropriate page. Now it is a simple matter to press control-alt to clear the key buffer. Thank you for putting such a clever embellishment on an already useful utility.

Bill Siebert, Spencer, NY

p-System Patch

Readers may be interested in the following error, which I discovered in Version IV of the UCSD p-System for the PC. The error occurs in *System4*, the program used for double-precision floating-point real numbers. I found that *System4* had only twenty-four bits of precision (approximately six decimal digits). The following is IBM's correction to the *System4* disk.

Boot the system; control is at the command level. Put the utility disk in the #5 drive, type *X*, and in reply to the prompt, type *#5:PATCH ⟨enter⟩*. Replace the utility disk with a copy of the *System4* disk and type *G⟨et⟩*. In reply to the prompt, type *#5:SYSTEM.INTERP ⟨enter⟩*. Type *R⟨ead⟩*, type *7 ⟨enter⟩*, type *V⟨iew⟩*, type *T⟨ype⟩*, and move the cursor down two lines. Type *H⟨ex⟩*; the cursor is now at *17*. Replace the 17 with 35 and press control-C. Type *Q⟨uit⟩*, *S⟨ave⟩*, and *Q⟨uit⟩* again. Control is now at the command level for a corrected version of *System4* with fifty-three bits of precision for floating-point reals.

G. J. Lastman, Waterloo, Ontario

Further Notes on Defense

George Hopkins, in his letter published in your November 1983 *Softalk*, takes issue with my letter objecting to articles on PCs used for "defense" purposes.

My intention in writing that letter was to voice my concern about what I have found to be a common phenomenon in technically oriented people: Namely, that we regard any piece of equipment with interest and have absolutely no regard for the use to which it is put. I do not consider nuclear weapons systems a political issue, nor am I a disciple of Neville Chamberlain or Yuri Andropov, as Mr. Hopkins insinuated. I do know, as does anyone who has taken the time to study the physics and biology of the results of the use of such systems, that a way must be found to eliminate and not glamorize them.

I did not want to use the pages of *Softalk* to discuss nuclear disarmament; I wanted to read a magazine that would help me make good use of the PC. Since you have felt it suitable to publish articles on the Department of Defense's use of the PC, I feel I have the right to voice my objections to those articles. Thank you for that opportunity.

Peter Feldmann, Santa Barbara, CA

Cursor Traces

The November 1983 "Questions and Answers" had a query from Henry Balaban concerning cursor traces when running his clock program from a batch file. My clock program had the same infuriating problem until I added ":SCREEN 1" in line 10.

```
10 CLEAR:KEY OFF:WIDTH 40 :CLS:
   SCREEN 1: BEEP :BEEP
20 LOCATE 25, 1 :
   PRINT "PRESS SPACEBAR TO STOP"
30 LOCATE 11,4
40 HOUR% = VAL(LEFT$(TIME$,2)):
   IF HOUR% ⟨ 12 THEN X$"AM" ELSE X$
   ="PM"
50 IF HOUR% ⟩ 12 THEN HOUR% =
   HOUR%-12
60 MIN$=MID$(TIME$,3,3)
70 SEC$ = MID$(TIME$,6,3)
80 MIN%=VAL(MID$(TIME$,4,2)):
   SEC%=VAL(MID$(TIME$,7,2))
90 IF MIN%=59 AND SEC%-59 THEN 10
100 IF INKEY$ =" " THEN GOTO 130
110 PRINT "THE CURRENT TIME IS ";
    HOUR%;MIN$;" ";SEC$;" ";X$
120 GOTO 30
130 SCREEN 0,0,0 :KEY ON :WIDTH 80
```

I work near a church, and the bells sound at the top of every hour. That's the reason behind line 90.

Mike McGee, New Orleans, LA

Make.bat

The programs described in "The Make File" (October 1983) are interesting, simple, and comprehensible, but they need some elaboration to become practical. The article suggests that Make.bat is only useful for programmers with weak memories. However, it also frees programmers from having to hover over multipass compilations. They can then do something else undistracted while the computer compiles the program.

To accommodate long error lists, Make.bat can redirect compiler output to a standard error file and then *type* that file back to the console. Error codes provide a clean approach but not the only one possible. Compilers that do not pass them may have other detectable side effects. For example, the Microsoft's Pascal compiler creates temporary disk files, Pasibf.sym and Pasibf.bin. When the first pass succeeds or the second pass fails, the compiler leaves these files on the default disk. Make.bat can detect errors by checking for the existence of these files. When combining assembly, Pascal, or other program files into one program, Make.bat can check source file extensions and send them to the appropriate program.

These are only a few possible extensions. Make.bat is never done—it should steadily evolve as the programmer discovers new tasks.

Fred R. Sinal, Hampton, VA ▲

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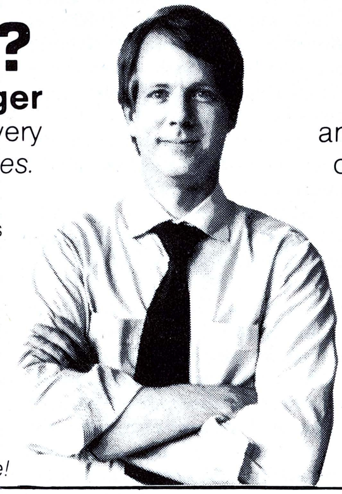

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* DOS likes to announce itself by typing A>. The cursor sits next to the >.
  This is called the "DOS PROMPT". When you see the DOS prompt you can count
  on this:

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@ GIVE DOS YOUR FIRST NAME
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QUESTIONS & ANSWERS

by Nancy Andrews

Q: What's this I hear about low-resolution graphics capability on the PC with a color/graphics adapter card? Can the PC really display 160 x 100 with all sixteen colors? If so, where can I find the support routines for this? I understand they were not put into the BIOS.

Tim Watson

A: Yes, the PC can really display 160 x 100 with all sixteen colors. What you do is change the parameters the CRT controller chip uses (that is, one hundred rather than twenty-five lines) and produce a trick graphics mode with the hardware in text mode. There are two catches: You can't have text on the screen at the same time (only the top quarter of the character is displayed); and certain Basic statements, such as *pset*, will not work. You can find more information on this subject in *Dr. Dobb's Journal*, December 1982 and March 1983.

Q: There are two problems I haven't been able to get an answer for:

1. When using *bsave* for an array (single- or double-precision), how many bytes of memory do you need to save, and how is the number determined? I tried using *varptr (0,0)* and *varptr (3,15)* to determine the start and end, but this doesn't seem to work because the last column of data on a *bload* is not complete. The only thing that seems to work is (row + 1) * (column + 1) * precision bytes. This ensures that all data is saved and loaded correctly but wipes out anything following the area where it is loaded. I would like to make a fast assembler sort routine to sort tables, but without knowing the start and end of data, this is impossible.

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2. When the Epson printer is used with the IBM PC, are there any *chr$()* characters that give problems? I have a lot of symbols that I am able to print with no problem. After looking at the screen dump program (July *Softalk*) and noticing that it prints a whole screen in one minute, I wondered why my printing symbols and data take so long. In order to print all the data on an eighty-column line, I only need numbers, blank, the letter *R*, and a colon as well as symbols I am already able to create. I coded up the data words for 0 to 9, space, and R, and then tried to output a 480-column set through a data loop using *lprint chr$(data)*, just as your print screen routine does. The symbols I regularly use printed correctly, but 0 through 9 printed out funny characters and started causing a line feed down the page.

Thomas M. LeGrande

A: Your formula for computing the size of an array is correct and should not wipe out data following the array. You could have this problem, however, if you have not calculated the number of bytes for single- or double-precision correctly. Multiply ((row + 1) * (column + 1) * 4) for single-precision and (* 8) for double-precision.

Your printer problem can be solved if you substitute the ASCII values 48 through 57 for the values 0 through 9. ASCII 48 corresponds to the numeral 0, ASCII 49 to the numeral 1, and so on. The only printable characters on the Epson/IBM printer are in the ASCII range 32 through 126.

Q: I am interested in creating a RAM disk for use with various software applications. In the DOS 2.0 manual I read about installable device drivers, and there is even some program code on page 14-27 for an in-storage virtual disk. My problem is that I don't know what IBM is telling me to do. Do I have the tools at hand to create a RAM disk in the DOS 2.0 environment?

Alan Miller

A: The simplest way to use the RAM disk installable device drive published in the DOS 2.0 manual is to assemble the program, using the *Macro Assembler*. However, the way your question is phrased suggests that you don't have the *Macro Assembler*. All is not lost. You can create a RAM drive using Debug; it's tedious and a bit tricky, but it can be done. Here's how.

Put Debug in drive A and a blank formatted disk in drive B. Log on to drive A and type:

```
DEBUG B:RAM.COM
```

When you see the Debug hyphen prompt, type:

```
E0 <carriage return>
```

and you're ready to begin. What you're going to type in is the *object code*, which occupies the third column of the RAM drive listing. The first column contains the *source code* line numbers, the second column contains memory locations, and the third column contains the code you will enter.

Begin with line 73 on page 14-28. Type one byte (two hex digits), then hit the space bar, then type two more digits, and continue in this manner. The space bar, not the carriage return, is what you use to move from byte to byte. The two digits you see to the left of the period on your screen are the values currently in memory at the location specified. The two digits you type are replacements for the current values.

To begin, type :

```
FF (sp) FF (sp) FF (sp) FF (sp)
```

The next two bytes, line 74 in the object code listing, contain the value

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2000. Whenever two pairs of digits are written without a space between, the pairs need to be entered in reverse order. So instead of typing 20 (sp) 00 (sp), type:

00 (sp) 20 (sp)

Then to enter line 75, type:

E1 (sp) 00 (sp)

Ignore the *R* whenever you see it following a line of code.

Continue entering the hex code and reversing the order of the bytes when there is no space between two bytes.

When you get to line 78 (location 000B) you'll see 07 [??]. What this means is that you should enter seven bytes of zeros. Type 00 (sp) 00 (sp) and continue with five more bytes of zeros.

You should now be at location 12, line 83. The object code for locations 12 and 14, *????*, should be replaced with zeros. At line 86, you'll see a value that starts with an equal sign. Ignore this line altogether—and all other lines that start with equal signs. Continue entering the object code, replacing question marks with zeros and rearranging the order of the bytes when there is no space between them.

Your first entries should look like this:

```
3635:0000    XX.FF  XX.FF  XX.FF  XX.FF  XX.00  XX.20  XX.E1  XX.00
3635:0008    XX.EC  XX.00  XX.01  XX.00  XX.00  XX.00  XX.00  XX.00
3635:0010    XX.00  XX.00  XX.00  XX.00  XX.00  XX.00  XX.00  XX.02
3635:0018    XX.01  XX.01  XX.00  XX.02  XX.40  XX.00  XX.68  XX.01
3635:0020    XX.FC  XX.02  XX.00  XX.16  XX.00  XX.00  XX.00  XX.00
```

Instead of Xs you will see the value previously stored in each location. When you come to the end of a line, do not press the carriage return. Continue to use the space bar, and Debug will automatically give you new lines as needed.

When you get to line 139, you'll see a semicolon in the object code listing. Ignore this semicolon and all subsequent ones. Also ignore the slash in line 182 (and any subsequent slashes).

If, as you are typing, you press the carriage return instead of the space bar, you'll need to type *E* and the location where you wish to resume entering code. For example, if you pressed the carriage return after entering the 01 in line 111, you would need to type E003D in order to continue entering code.

If you want to stop and check out what you've just entered, press the carriage return to leave Debug's Enter mode. Then type *E* and the address of the code you want to check. If, for example, you want to check your work from the beginning, type *E0000*. Your screen should display the first byte of code you typed in, FF. If you find the correct value there, press the space bar to display the value stored in the next byte. You can check each byte in turn, just by continuing to press the space bar. If you find a value that needs correction, enter the correct value; then hit the space bar to move to the next byte.

Line 397 is the last line you need to enter. When you finish typing in the code, type in sixteen additional bytes of zeros and then press the carriage return to leave the Enter mode.

Since you're entering the code manually, you must also *link* by hand. At certain places in the code there are subroutine calls and jumps for which addresses need to be computed. The first of these is at locations A4 and A5 (line 169). 007D needs to be replaced with the difference between its value and the location of the next instruction; in this case you need to subtract 00A6 from 007D. What you get is FFD7, and this is what you need to put at locations A4 and A5. Begin by typing *EA4* (carriage return). Now type *D7 (sp) FF* (carriage return); note that the FFD7 is entered in reverse order, because there's no space between the bytes. Other locations that need to be changed are listed below. Enter the changes the same way as in the example above.

LOCATION	OLD VALUE	NEW VALUE
C1 and C2	007D	FFBA
156 and 157	007D	FF25
17C and 17D	007D	FEFF
195 and 196	007D	FEE6
1B6 and 1B7	0288	00D0
1CA and 1CB	0288	00BC
1DD and 1DE	007D	FE9E
213 and 214	0062	FE4D
226 and 227	00A3	FE7B
242 and 243	0062	FE1E
255 and 256	00C0	FE69

Before you can write this program to disk you must store the length of the file in the CX register. To do this, type *R CX* and a carriage return. Then type *02A0* and a carriage return (do *not* reverse 02A0). Finally, type *W* to write RAM.COM to disk. You should see the message:

writing 02A0 bytes

To get out of Debug, type *Q*.

Congratulations! You've completed the program, and if all is correct you should have a properly functioning RAM disk.

Now, to use the RAM disk, you need to add it to your Config.sys file. If you don't already have a Config.sys file, create one on your DOS disk. All it needs is the line:

device = RAM.COM

Copy Ram.com and Config.sys onto your DOS disk, and when you boot, your virtual disk will automatically be created.

Your RAM disk will automatically be assigned the next available drive letter; if you have two drives, DOS will make your RAM drive drive C. If you have followed all of these steps and your system hangs or you get some other peculiar behavior when you boot, chances are you have an error in your RAM disk code. Use Debug and go back and check your listing byte by byte; when you load a .com file into Debug, it's automatically loaded at location 100. So to check your listing, add 100 to each location shown in the DOS manual.

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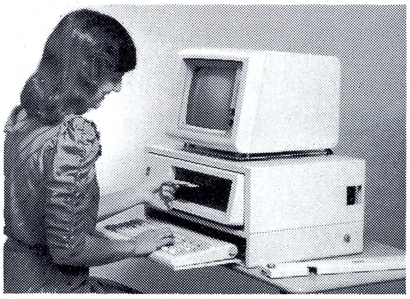

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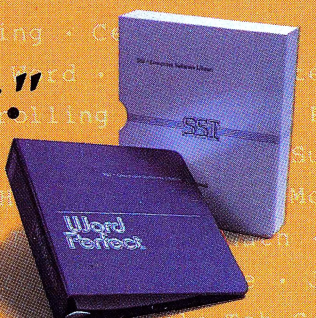

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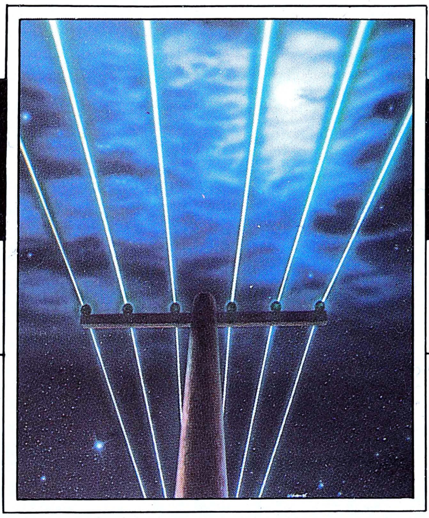

COMM LINES

by Kevin Goldstein

Communications Software

In previous installments, we examined modems in painful detail: why they're needed, how they work, what features and options they offer, what they cost, and so on. But as important as this electronic gateway between computer and phone line is, a modem is only half of what you need to set up your electronic cottage. The communications software that drives your modem is equally important—perhaps more so.

So, in this installment, we'll take a look at the role of communications software: what it does, features, options . . . you get the idea. Fortunately, most of the concepts we'll deal with here we've already taken up in connection with hardware; all we'll be doing now is looking at familiar ideas from a new perspective.

If you think back to an earlier column (October 1983), you'll recall that when you plug a modem into an asynchronous communications board, what you're doing is connecting the modem, via some buffers and amplifiers, to an integrated circuit called a UART, or universal asynchronous receiver transmitter. The UART's primary job is to assemble the stream of bits coming from the modem into eight-bit bytes, which it then hands over to the processor as single units (the UART, of course, does just the opposite with data headed in the other direction). While it would be possible to omit the UART entirely—indeed, some low-end computers do—the UART's ability to relieve the main processor of drudge work makes it a welcome component of almost all communications channels.

Readers of this column are by now well aware of the vast range of performance options offered by different modems, or even by the same modem. True to their name (the U stands for *universal*, after all), UARTs can be programmed to handle that vast range of options. And programming the UART to meet the user's specifications is the first task of communications software. In more impressive (?) terms, this process is sometimes called "configuring the channel."

All the popular communications programs now on the market offer some way for you to specify the channel parameters, or options. If they didn't, you'd have to use the infamous DOS *mode* command; if you absolutely must try that command, bear in mind that although you configure the channel in DOS, it's likely that your software, when you boot it, will reinitialize the channel to its own defaults. The better programs have default configurations that are automatically invoked if you fail to specify a setup; in general, such software allows you to specify just what your default configuration should be.

Well, what should it be?

Glad you asked. No one set of parameters will satisfy all situations you'll encounter, but the following setup is likely to handle most. Fine tuning might give you more efficient performance in some situations, but this setup will serve you well most of the time. The envelope, please.

Baud rate:	**300**
Parity:	**even**
Number of data bits:	**7**
Number of stop bits:	**2**
Echo:	**Off**
Comm Port:	**Com1**

Recognize all those? Baud rate you're of course familiar with, but it's worth saying a few more words about it here. First, just because 300 baud works, don't assume that the modem you're talking to is limited to 300 baud. Many lines now are capable of automatic speed selection, which means that if you start spitting out bits at 1200 baud, the modem on the other end will automatically configure itself for 1200 baud and thereby save you money on connect charges—not to mention valuable time.

There are various ways to configure your line for high-speed operation; this is one subject on which you'll have to consult your manual. In general, a modem's default speed is set by switches on the modem itself (on the Hayes and Novation, these switches are behind the front panel; pry the panel off with a small screwdriver). Although in theory the transmission speed is immaterial as far as the modem is concerned, in practice many of today's intelligent modems must know the baud rate, since they continually monitor the line for commands directed at them (the modem). Thus automatic speed selection has become a cooperative effort between the modem and the software. The Hayes Smartmodem, for example, co-opts RS-232 line 12 and turns it into a speed-selection line; the modem uses this line to inform the computer of the baud rate at which data is being received (good to know, of course, during auto-answer operation, when any damned fool doing who knows what could be at the other end). That information lets the communications software configure the UART for transmission and reception at 1200 baud.

(Incidentally, don't try to change the transmission speed once a connection has been established; even automatic speed-select circuitry will choke on that trick.)

Any game that requires cooperation is prone to misunderstandings; this one's no exception. As an example of how things can go wrong, consider what might happen if you set the default switches in your modem for 1200 baud without changing your software's defaults. Everything would work fine on incoming calls (assuming auto-speed selection). But try to auto-dial a call, and whamo! Because the software would have set the UART for the old speed of 300 baud but the modem would still expect to see dialing commands sent at 1200 baud (the default speed you set on the switches), you'd have a problem. Beware.

Back to our configuration list. The second option is parity, which in this business has nothing to do with missiles. In telecommunications, parity refers to a simple error-detection scheme.

It works like this. Suppose we wish to send the letter A, which in ASCII has the seven-bit binary pattern:

```
0110101
```

We've specified the character in seven bits instead of eight, because ASCII is officially a seven-bit code. The PC's version, which IBM

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calls "extended ASCII," adds an eighth bit, which enables it to include 128 more characters. IBM left the code for the first 128 characters alone, however; in IBM ASCII, the character *A* looks like this:

`00110101`

In other words, the eighth (most significant) bit is simply 0. Since most *text* transmission is done in standard ASCII, we'll stick with the seven-bit code for now (we'll get to *non*text transmissions shortly).

Meanwhile, back to parity. Let's calculate an *even parity bit* for the character A. First, count the number of 1 bits in the character. That's right, there are four—the first, third, fifth, and sixth bits, counting from the right. Let's see, now; four is an even number, so if we slap on a parity bit of 0, we'll still have an even number of 1 bits. Here's our character with the parity bit added:

`00110101`

That's it, folks. Parity is simply an extra bit appended to the character in such a way as to make the number of 1 bits even.

Well, that's almost true. We've just defined *even parity*; there's also such a thing as odd parity. In odd parity, the extra bit is added in such a way as to make the number of 1 bits odd. Here's the character A in odd parity:

`10110101`

Since the character A has four 1 bits, the parity bit—under odd parity—has to be a 1.

Adding a single parity bit to each character to be transmitted is a decent way to detect certain kinds of errors.

Not overwhelming, but decent. If, during the transmission of an A using even parity, a single bit gets dropped, what was

`0110101` becomes: `0110001`

In other words, an A turns into an =. The equal sign is a perfectly valid ASCII character, but if we calculate its parity (that is, if we count the number of 1 bits received) we find it's odd. In even parity we're always supposed to have an even number of 1 bits, so we know there's been an error in the transmission.

Single-bit parity is not a perfect scheme. For one thing, it can only detect single-bit errors. If two bits are dropped, our A might go from 0110101 to 0110000, retaining even parity; the error might escape detection.

Fancier schemes exist that can detect multiple-bit errors; some can even *correct* single-bit errors and detect multiple-bit errors. Those schemes, which have such names as fire code and cyclic redundancy check (CRC), have their place; disk drives, for example, make use of these fancier schemes.

Generally, when a more certain guarantee of data integrity is needed in telecommunications, an entirely different error-detection method is used. One such scheme, the Christiansen protocol, is used by some of the soft-

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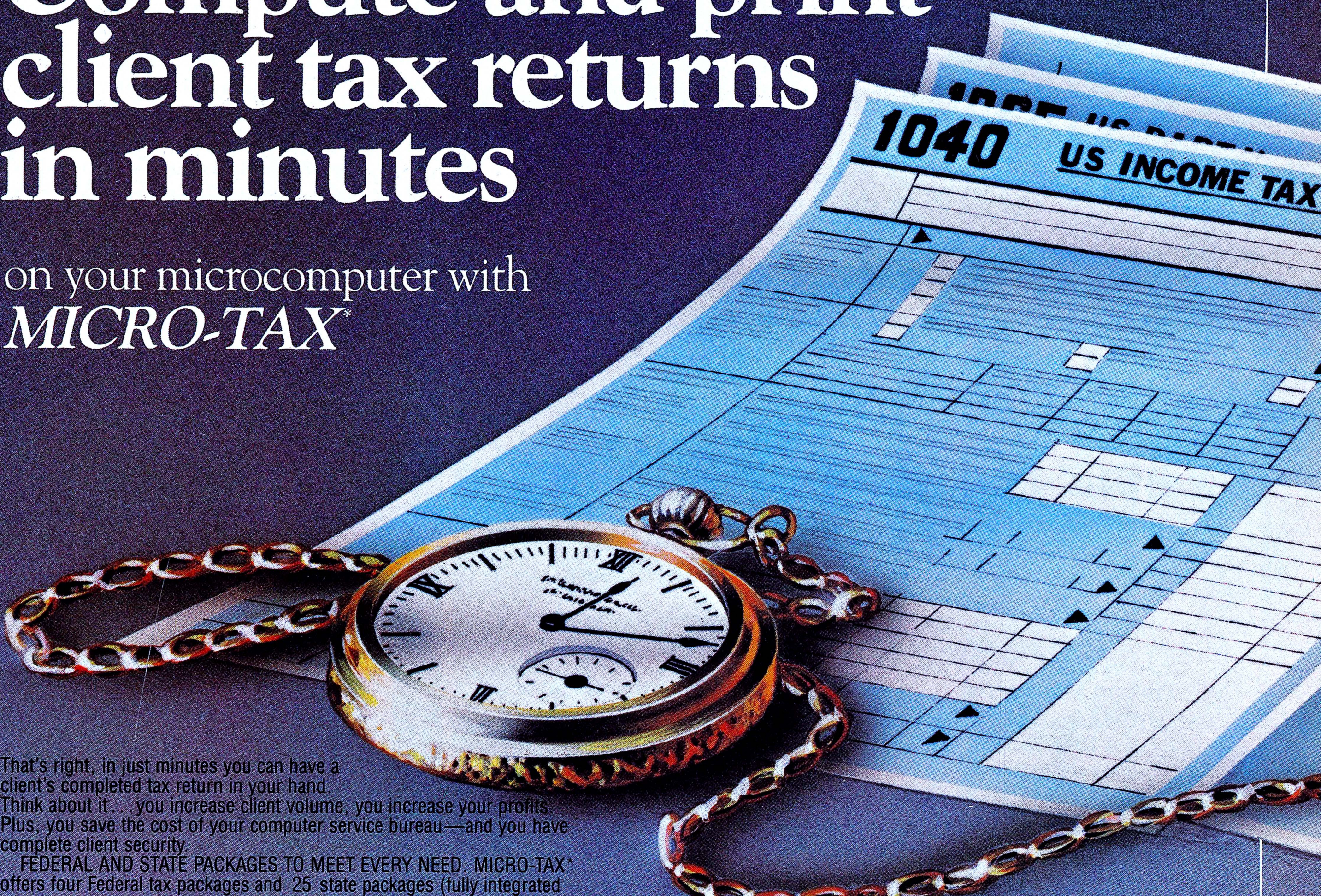

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ware bulletin boards (when software is sent over a comm line it must be sent without undetected transmission errors). Rather than calculating a parity bit for each character, the Christiansen protocol groups sequences of adjacent bytes, calculates some *check characters*, and adds the check characters to the end of each group. Errors in transmission are caught when the receiver calculates the check characters. The Christiansen protocol includes a scheme by which the receiver requests retransmission when it finds errors.

Many of the bulletin boards and services you'll use implement parity; it's a cheap and by now almost universal way to keep the error rate under control. Even parity is the more common choice, which is why our default list specifies it. But it's not universal. When you use a new system, check that you and it are using the same parity (odd or even); some systems don't use parity at all; these systems simply ignore the parity bit. If you run across a service that uses the Christiansen protocol, you'll need communications software that understands it.

Back once more to the default list. The next item is the number of data bits. We already covered this one in part, when we noted that seven-bit ASCII is by far the most popular way to encode text. That means you can use it to send text files to a friend, or when communicating with a bulletin board, your bank, The Source, or other such entities.

A seven-bit code has certain disadvantages. You can probably come up with one right off the bat: It makes it awkward (although not impossible) to send the complete eight-bit IBM extended character set. As a matter of fact, programs, as distinguished from data, are manipulated by bytes, eight bits at a time. To facilitate the transmission of programs, most comm channels also can handle eight-bit data words; this is the option to specify when you're downloading a program.

Using the seven-bit ASCII code is frequently referred to as being in text mode, since this mode is appropriate for sending text data. Using an eight-bit data word puts you in binary mode. It's somewhat silly terminology, for a couple of reasons: Both encoding schemes are obviously binary, and it's quite easy to send standard seven-bit ASCII text characters in binary mode.

The next item on the list is a quickie: number of stop bits. Recall that the UART surrounds each character it sends with two bits, a start bit at the beginning and a stop bit at the end. Or maybe two stop bits. Old communications gear with looser timing needed that second stop bit. For the most part, the extra stop bit is a relic of times past. It won't hurt, but it will slow things down a bit (literally). A comm channel that expects to see two stop bits will complain if it gets only one; a channel expecting one and seeing two simply interprets the extra bit as a delay of exactly one bit between characters. For speed, it's preferable to go with a single stop bit, but if you have no idea what the far end is doing, go with two and make the change later.

And finally we come to echo. In the early (earlier? We're really just getting started.) days of telecommunications, when you typed a character, the character wouldn't immediately appear on your end. Instead, the far end, which back then was most likely a mainframe, would *echo* the character back to your terminal so you could see what you'd typed. While this appears to have been a grand waste of a full-duplex line, it did provide a visual check ensuring that what you thought you sent was what the mainframe got.

In practical terms, echo means this: If, when you type, you get double characters, you need to turn echo off. Your communications software, not expecting characters to be echoed, is itself printing them to the screen; when the character *is* then echoed, you get doubles. On the other hand, if you're typing into a blank screen, turn echo on. Most comm programs give you a convenient way to toggle echo from the keyboard at any time. ▲

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EXEC LOTUS

1-2-3 STEPS AHEAD

by Kevin Goldstein

Two years ago, very few people in the personal computer community had heard of Lotus Development Corporation's Mitch Kapor. Today, very few haven't heard of him.

Kapor's high profile has come on the coattails of the success of *1-2-3*, a software bestseller whose sales are so unbelievably strong that they dwarf the sales of the number 2 program by a factor of more than three to one. And while at first blush a success that large would seem to be impossible without a great amount of plain luck, the facts point more to clever thinking, hard work—and to a nonconformist who was willing to follow his instincts.

From an outsider's perspective, Kapor's—and Lotus's—rise to the top sounds almost too easy to be believed. It goes something like this: Write a pair of business programs and sell them to VisiCorp for well over a million dollars; take the money and start a new company; interest some well-heeled venture capitalists in the new concern (to the tune of several million more dollars); use that money to develop a new software package and bring it to market with a big—no, huge—splash. Then settle back and enjoy.

That's from an outsider's point of view, of course. Things don't look quite the same from the other side of the table.

The idea for *1-2-3* did not form in a vacuum, nor, like Athena from Zeus, did it spring full-blown from Kapor's head. *1-2-3* actually had a pretty long gestation period.

Kapor's initial exposure to computers and programming happened in high school, waaaay back in 1965, when he took a couple of programming courses. "I was a nerd *manqué* in high school," Kapor recalls with a grin. "I mean, I was considered a real math whiz."

A math whiz who wasn't very committed to math, he might have added. It seems that upon getting to Yale, the whiz "got turned around," and went off to become a transcendental meditation teacher and a disc jockey (now there's a synergistic combination!) before finally settling down to get a master's degree in psychology.

By now the year was 1977, meaning it had been an even ten years since Kapor had abandoned math for pursuits more humane. Yet however repressed and neglected Kapor's earlier persona—what he laughingly called the nerd *manqué*—may have become during all those years, it clearly wasn't dead: When Radio Shack introduced the TRS-80 Model One in 1977, "I just got hooked," Kapor says. "I was simply fascinated by the idea of personal computers, and I kinda just dropped all this other stuff I was doing, got a Model One, and got into it." Six months later, firmly addicted, Kapor bought an Apple.

Kapor quickly realized that there was a world out there that wanted to use these new beasties but knew nothing about them; this realization led him quite naturally into consulting work.

You get the feeling from talking to Kapor that he's a good guy. Easygoing—he wore a tan suit, tie, and sneakers to Comdex—and easy to talk to, he's the kind of person that you know would make a good friend. Which probably explains why he decided to do some *free* work for a graduate student who was trying to write his doctoral thesis and wanted to do the computer work on a micro rather than a mainframe. As Kapor tells it:

"It turned out he wanted some statistics routines, multiple regressions. I said, 'Well, you tell me what multiple regressions are, this sounds interesting.' And I wrote it up—it took about seven days—and it worked. Then one day I was sitting around with a friend and partner on that project, Eric Rosenfeld, and I looked at him and said, 'You know, I bet people would pay money for this.' "

They certainly would. With Dr. Rosenfeld doing much of the design work, Kapor proceeded to write *Tiny Troll*, a subset of an MIT statistics language that did line charts, multiple regressions, and statistics, and that counted a data editor among its features. So it turns out that the work Kapor did for free for that graduate student led to *Tiny Troll*, and the importance of that becomes obvious when you realize *Tiny Troll* can be described as an integrated software package.

At about this time, some of Kapor's other activities started to dovetail nicely with his work on *Tiny Troll*. Kapor estimates that by this time the number of people in the Boston area who had popped for Apples must have reached the astoundingly high figure of twenty, or maybe even thirty, so he and a few of the others got together and started an Apple user group, which turned out to be the *first* on the East Coast. One of the earliest members of that pioneering assembly was Bob Frankston, one of the two codevelopers of *VisiCalc*. Frankston met Kapor at a user group meeting and mentioned that his software publisher (VisiCorp, at that time called Personal Software) was looking for new products to publish.

Why, what a coincidence! It so happened that Kapor had a nice statistics package, complete with graphics and a text editor, that needed a publisher.

Thus it was that Frankston introduced Kapor to Dan Fylstra of Personal Software. Out of that meeting a contract eventually developed that called for Kapor to produce a graphics and statistics package for the Visi series. The program would be based on *Tiny Troll* but would incorporate additions and changes.

Mitch Kapor of Lotus explains the evolution of 1-2-3. *Kapor, a self-described Basic "hacker," began with a program called* Tiny Troll. *Later, he sold* VisiPlot *and* VisiTrend *to VisiCorp for $1.2 million—money which he later used to underwrite* 1-2-3.

Kapor delivered *VisiPlot* and *VisiTrend* in 1980, and the products were introduced in April of 1981. They proved to be Kapor's first big break: In a period of only six months, he raked in almost half a million in royalties.

"I had a very attractive contract from my point of view," he explains, "because when that contract was signed in '79, people didn't really understand the economics of this business. Today, software publishers offer ten or fifteen percent royalty contracts; I had a *thirty-three* percent contract." That, combined with the healthy sales of *'Plot* and *'Trend*, explains why VisiCorp, in 1982, was more than willing to buy out Kapor's contract for the somewhat princely sum of $1.2 million.

Kapor did not take the money and retire to the Cayman Islands, however; as a matter of fact, he barely took a vacation. His plan was to "do more products," or, more correctly, to design more products. "I wanted to hire *real* programmers this time around," he says.

Real programmers? What does Kapor consider himself?

"One of the world's great Basic hackers," he says matter-of-factly. "*Tiny Troll*, *'Plot*, *'Trend*, and everything else I wrote was all done in Basic, and I knew that I had hit my limit as a programmer."

So the plan was to do the design work, hire some programmers, and let VisiCorp or another company publish the results. "But it turned out that it just wasn't going to happen like that in a satisfactory way," Kapor recalls. "This author-publisher model had lots of problems about control, fights about marketing, and just too many other problems, so I was backed into the idea of a company that would do development and marketing. I simply didn't see any alternative."

Kapor's decision to do the design work and let others—most notably Jonathan Sachs—do the writing proved propitious. *1-2-3* owes its success in large measure to its user interface: intuitive, easy to use, and helpful. Kapor attributes the success of that interface to his way of looking at programs, which he describes as a user's perspective, rather than a programmer's.

"I work on products by asking a set of questions," he explains. "Questions like: What do people need? How can we insulate the user from the peculiarities of the computer? And how can the total experience of the session be made most natural and most intuitive?"

Today, it's pretty conventional to ask those questions before starting a new programming project, but in 1979 it was a fairly radical way of thinking. "But that is just naturally the way I look at these issues, partly because, when I was doing mainframe stuff in college, I was incredibly frustrated by the machine.

"I can't program in assembly language," he continues, almost wistfully, "and it seems so arbitrary—the priesthood of the systems programmer. It's an incredibly emotional thing, out of which came the very strong feeling that I ought to be able to sit down and use a personal computer without first being ordained by the priesthood."

With that background, it's not surprising that Kapor was "simply blown away by *VisiCalc*." So impressed was he with *VisiCalc*'s method of pointing to data that when he sat down to write *VisiPlot*, "rather than extending *Tiny Troll*, I said, 'We've got to throw the whole interface out—this pointing stuff is just great.' "

According to Kapor, "Pointing is an analog to real life; everybody knows how to point to things." So he took the idea and ran with it, extending *VisiCalc*'s notion to include pointing to commands as well as data. The result, in *VisiPlot*, was a moving-cursor menu, an idea that has since become more or less a standard in sophisticated programs.

Makes you think that there's no way of stopping an idea whose time has come. Pointing, in particular with a mouse, had also appeared about this time three thousand miles away, at Xerox PARC (Palo Alto Research Center) in Palo Alto, California. Kapor swears he had not heard of Alan Kay's work there at the time he wrote *VisiPlot*. In any case, the first popular program to use pointing menus came from Kapor, not from PARC.

But back to our story—and to the products that Kapor planned to develop and publish after he got his $1.2 million from VisiCorp. By now it's quite clear where the concepts behind the user interface came from; and the idea of an integrated program had appeared a long time ago in *Tiny Troll*, *VisiPlot*'s precursor.

"The idea for *1-2-3* really came before *'Plot* was even on the market," Kapor says, "but it was very vague—the notion that a spreadsheet ought to have graphics commands. Again, the key is convenience."

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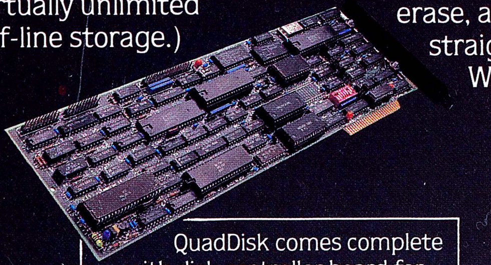

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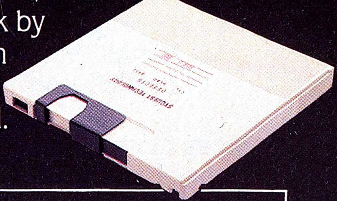

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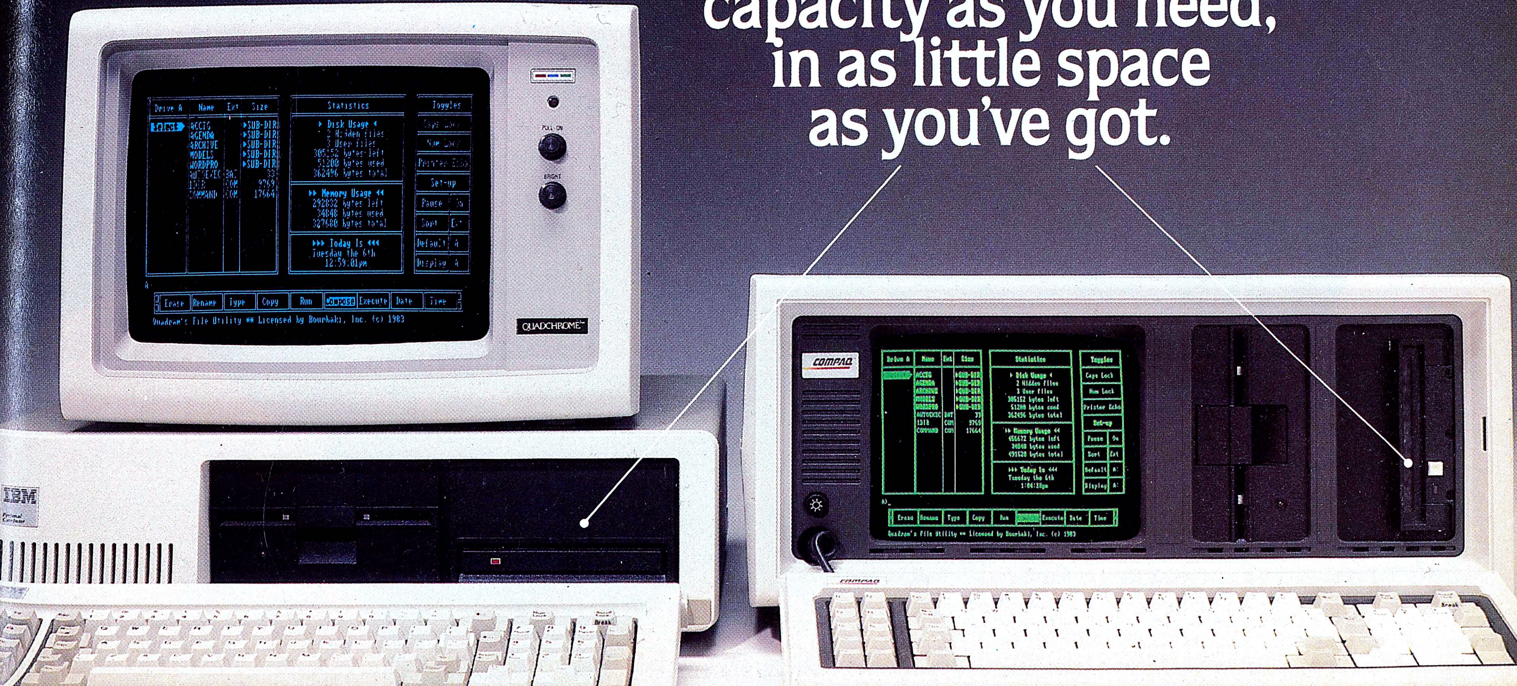

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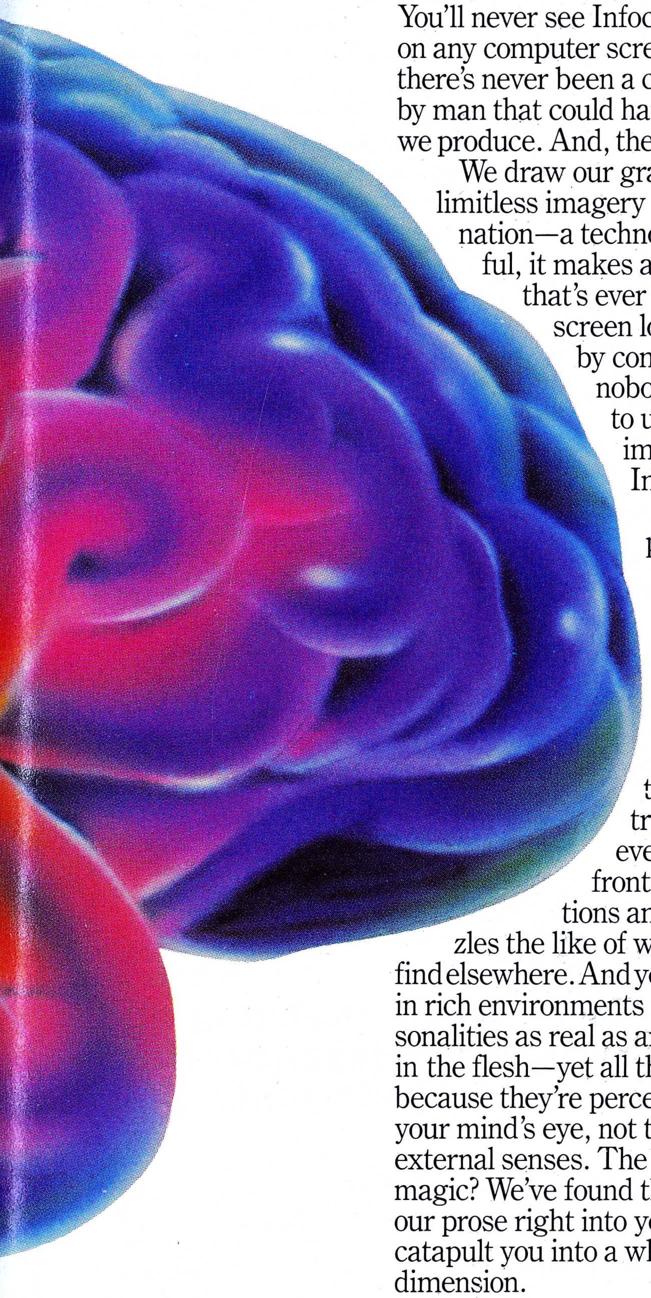

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Thus it was that when Jonathan Sachs, an assembler guru who conveniently happened to possess the rights to a spreadsheet package, got together with Kapor in 1980, all the ingredients were in place for mixing up a new program, *1-2-3*. Well, almost all.

"IBM announced its PC in August of '81. We looked at it for a few days and said, 'Aha! This is the machine to go with.' " Kapor was seduced first by the fact that the PC used a sixteen-bit processor, which meant it could properly support more than the 64K that the standard Apple II was then limited to. Second, Kapor believed that IBM made a lot of the Right Moves: retail distribution, third-party support, a completely open system.

"We decided both to write for the PC and to optimize for it," he recalls. "Everybody else had eight-bit software, and it was going to take a long time to redo it." And even then, it would still only be eight-bit software pasted onto a sixteen-bit machine, certainly *not* the best way to use resources.

Kapor and Sachs were quite serious about optimizing their new baby. It's a little-known fact that what was later to become *1-2-3*'s spreadsheet was first written in C; that version was both too slow and too large, so Sachs rewrote it in assembler. (Versions of *1-2-3* for other machines, such as those based on Motorola's high-performance 68000, are written in C.)

As originally envisioned, *1-2-3* was to be a single package with a number of functions. It was known from the start that the first two of these functions would be graphics and a spreadsheet, and it was assumed that a third function would be a word processor. "But the guy we hired to do the word processor quit," says Kapor, "and anyway, it was easier to see how to integrate a database into a spreadsheet than it was a word processor." Which is why the original *1-2-3* doesn't have a word processor.

With work on *1-2-3* now well under way, Kapor turned some of his attention to finding the money to deliver his precocious baby.

"I knew Ben Rosen [of Sevin-Rosen Associates, a venture capital firm] because Ben had been a *Tiny Troll* user." Kapor smiles. "I used to answer his support calls."

So Kapor approached Rosen with his idea, and Rosen in turn asked for a simple precis—not even a complete business plan. "I put that together, he looked at it, and L.J. [L.J. Sevin, the second principal of Sevin-Rosen] looked at it, and six weeks later we went to dinner, and during the salad L.J. said, 'Ben and I would like to invest in your company. How much do you think it's worth?' I dropped my fork, said 'Uh oh,' and we did a deal." Rosen and Sevin put in $600,000 in the first round of financing, and other venture capitalists added an additional $400,000, for which the investors received 30 percent. Kapor retained 30 percent, Sachs and other principals had "a bunch," and 27 percent was reserved for future employees. Sevin-Rosen kicked in another $2.5 million before *1-2-3* was announced.

The rest is legend: *1-2-3* was first shown at Fall Comdex 1982; Lotus wrote over a million dollars' worth of advance orders at Comdex, and the program took off like a shot, reaching the top position in *Softalk*'s bestseller chart in April 1983.

One question remains: Did Kapor realize at the outset how wildly successful *1-2-3* would be? "The way it works is like this," Kapor says. "You shoot an arrow into the target, and then you draw the little circles around it. You shoot a bull's-eye."

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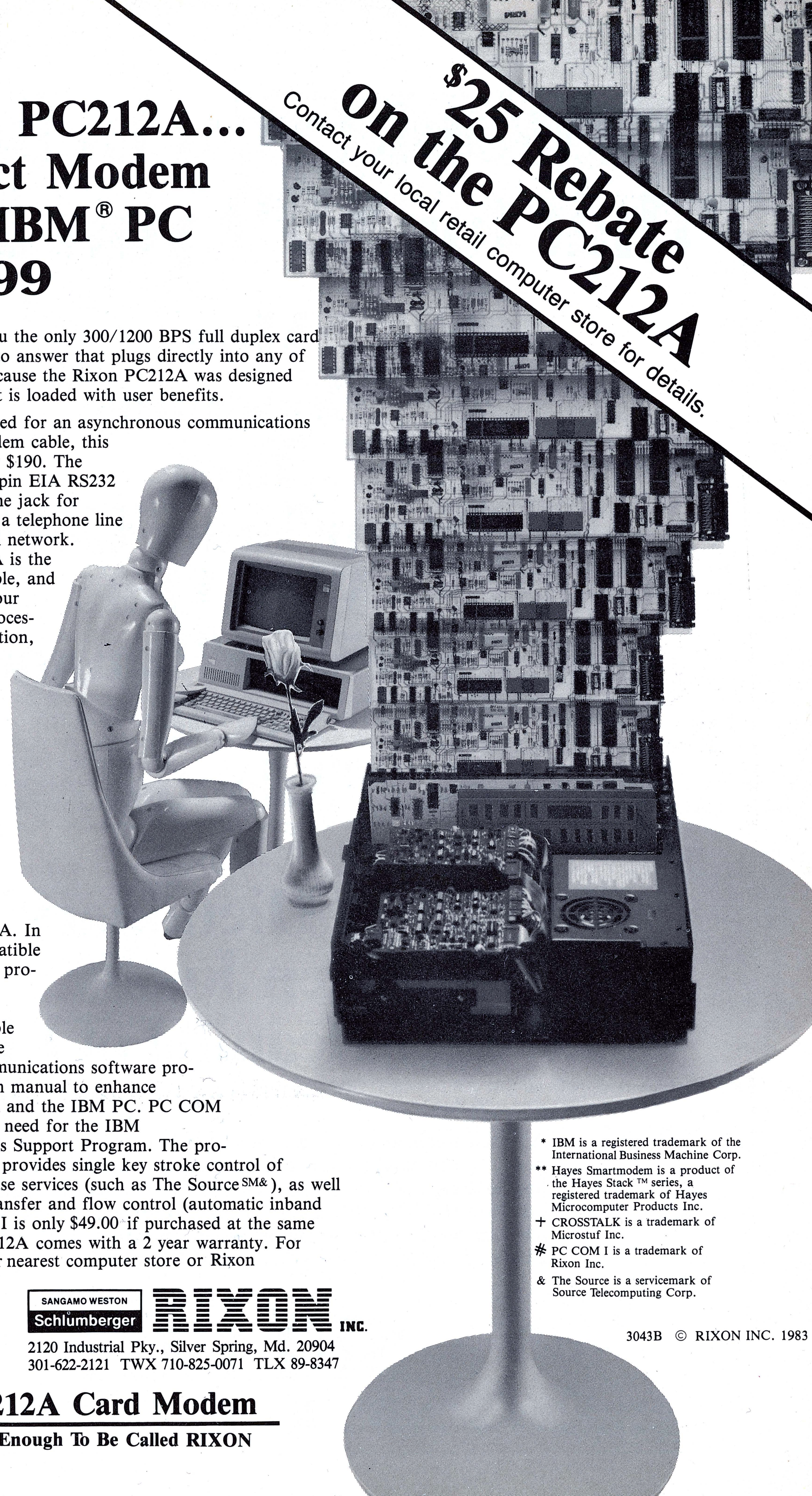

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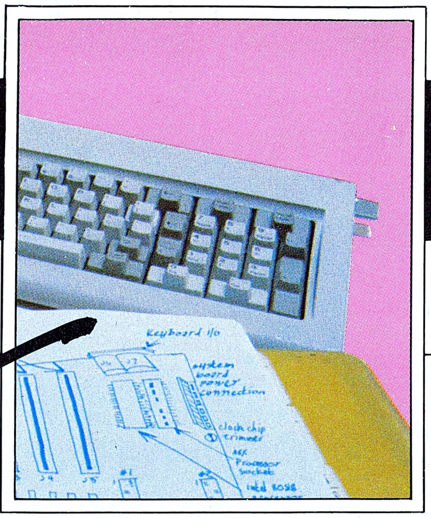


SYSTEM Notebook

by Alan Boyd

The *Print* Command

The command we'll look at this month introduces us to a whole new ball game—multitasking.

Without a doubt, one of DOS 2.0's most heralded features is its ability to perform background printing—also known as print spooling. An external command, *print*, allows you to specify and queue files that you want to have printed. As if by magic, your printer prints the files you specify, at the same time leaving you in control of your machine so that you can run other DOS commands or programs while the printing is going on. Multitasking? Yes, but in a limited manner.

Background printing (print spooling) is not exactly a new feature for the PC; many word processing programs offered this capability even before DOS 2.0 arrived. Running a word processing program with printing going on in the background is a fairly simple task for a personal computer to accomplish, providing there's sufficient memory.

But what does it mean for an activity to be going on "in the background"? And why are print spoolers so popular? To answer these questions you first have to understand how computers generally approach the problem of storing information they're not immediately acting on.

As you may know, many of the PC's system-level functions are controlled by interrupts—signals that cause a momentary discontinuity in the running of an application program (or, for that matter, of the operating system itself). The system clock causes an interrupt every eighteenth of a second (approximately); for example, the keyboard generates an interrupt every time you hit a key, and a whole range of other processes are also "interrupt-driven." One of the common uses of interrupts is to inform the central processing unit that a peripheral device has completed a task.

The method by which a file is sent to the printer provides a good illustration of the interrupt process.

Your computer operates at much higher speeds than your printer. The internal speeds of the computer are measured in millions of cycles per second, whereas the speed of the printer is measured in characters per second. The IBM dot-matrix printer and its Epson counterpart, for example, are capable of delivering only about eighty characters per second. Obviously, then, there is a great capability gap between the printer and the PC.

To cope with this gap, most printers contain buffers, small amounts of memory that hold information waiting to be printed. There is usually a direct connection between the PC and the printer's buffer—either a serial or parallel connection.

Suppose your printer has a buffer capable of holding only one eighty-character line and you have just instructed the PC to print a file consisting of four such lines. The first thing that the PC does is send a signal to the printer, called *a request to send*. If the printer is prepared to receive information, it will acknowledge the request and send back the computer equivalent of an okay. This is part of the protocol, or handshaking, that keeps an orderly flow of information between computer and printer.

Whenever the PC receives the okay-to-send signal, it delivers the first line. At that point the printer buffer is filled, and the printer sends a message to the PC telling it to stop sending characters. Having received this message, the PC then sits around and waits for space to be cleared in the printer's buffer so that it can send the next line. When the coast becomes clear, the printer sends an okay back to the PC, which then sends another line. This process is repeated until the entire file has been transmitted and then printed.

Very efficient, you might think. This form of data transfer is actually quite efficient, providing that there's a high-speed device, such as another computer or a smart printer with a large buffer, on the receiving end of the communications link. When the PC is "talking" to a slow printer, however, it spends about 90 percent of its time just sitting around waiting for the printer to send back an okay.

To expedite matters, a routine residing in DOS allows the CPU to get on with other work while it waits for the printer's okay-to-send signal. This print spooling is implemented entirely in software, by means of interrupts. Essentially what happens is that an interrupt signal is generated whenever the printer is ready to receive data; the rest of the time the computer is free to handle other tasks.

Whenever the PC is running more than one task, a potential for conflict exists. What happens if both tasks need access to the same resource at the same time? To deal with this possibility, tasks are assigned priorities. The task with the highest priority is called the *foreground task*, and any other tasks are called *background tasks*. Since the printer is (relatively speaking) a very slow physical device, print spoolers are usually implemented in such a way that the printing goes on in the background.

This is not, however, the way the DOS *print* command is implemented. Contrary to custom, printing via the DOS *print* command actually works in the foreground. From your perspective as a user, there is essentially no difference between this method and the traditional approach, except that any task you run while a print is in progress may be inefficient and/or subject to noticeable slowdowns.

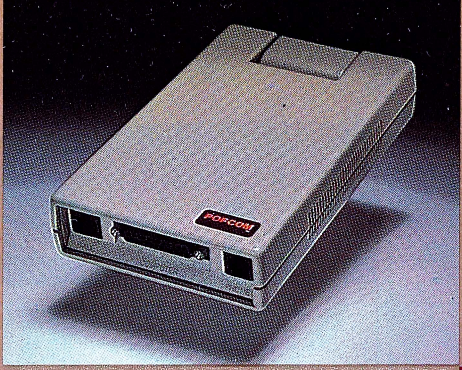
For convention's sake, we will always refer to concurrent printing as though it were a background process.

The *print* command itself is quite powerful but has some limitations. Although it's a simple utility, it does demonstrate that the PC is capable of multitasking (a portent of things to come?).

Using the *print* command is easy. To print a file, just enter the command

```
A>PRINT filename
```

The best method of learning the *print* command is to create some dummy files and play with them. To do this you'll need a word proces-



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sor or text editor. If you have access to neither of these, you can always use the Edlin minieditor supplied with DOS.

To create the dummy files File1.txt, File2.txt, File3.txt, and File4.txt, simply enter one line into the text editor and use the editor's facilities to duplicate the line over and over so that the final document is longer than a single page. The line you enter into the files should identify the filename so that when you look at the printout you'll know which file is currently being printed. To make things simple, use a line like

This is the file named File1.txt

so you can substitute the appropriate numbers for your other files.

If you use a word processor to prepare the files, make sure that it writes an ASCII file to the disk. If your word processor doesn't do this, use its print-to-disk command, which has the same result. If you're not sure whether your file is ASCII, you can check it via the DOS *type* command; if the file appears as gibberish on the screen, you haven't created an ASCII file.

Armed with the four files you've just created, you're ready to take on the *print* command. The first exercise is to enter the command

```
A>PRINT FILE1.TXT
```

and see what happens. If all goes well you should be rewarded with a prompt from DOS requesting

```
Name of list device [PRN]:
```

meaning that DOS needs to know how your printer is set up, or indeed which printer to send the file to if you have more than one connected. If your printer is connected to the standard parallel port and is usually addressed as the standard device Prn, then you can simply press enter to continue. If your printer is connected to any of the other ports, then enter the reserved name for the port—Com1, Com2, Aux, Lpt1, Lpt2, Lpt3, or whatever—and press enter.

When this is done, DOS will print the message

```
Resident part of PRINT installed
```

You need to go through this process only once when you start your system. Any subsequent time you use the *print* command you will not need to set the device parameter again.

DOS then emits the message

```
A:FILE1    .TXT is currently being printed
```

to show exactly what is happening. Whenever the printer starts up, the DOS prompt will return and you can operate your PC as if it weren't printing the file. Try some of the usual DOS commands like *dir* and *type* and observe the effect they have on the printer. You will see that some commands will bring the printer to a halt, since the processor is busy tackling another job.

This is all very nice. You have just experienced real multitasking on the PC. But what happens if, while the background printing is in progress, you issue a second *print* command? Try it and see. If the printing stops before you get a chance to enter the second command, then simply reenter the command, immediately followed by a second *print* command.

```
A>PRINT FILE1.TXT
  A:FILE1    .TXT is currently being printed
  A>PRINT FILE2.TXT
  A:FILE1    .TXT is currently being printed
  A:FILE2    .TXT is in queue
A>
```

Obviously DOS can't run two different versions of the *print* command at the same time, so it queues the files—it creates a list of files to be printed. If you were immediately to add a third *print* command, then DOS would add that file to the print queue.

```
A>PRINT FILE3.TXT
  A:FILE1    .TXT is currently being printed
  A:FILE2    .TXT is in queue
  A:FILE3    .TXT is in queue
A>
```

Whenever a file has finished printing, the *print* command causes a page eject to be sent to the printer, ensuring that each file will be started on a new page. It then removes the completed file from the queue and bumps each of the lower priority files up one level.

If you want multiple copies of a file, just enter the command once for each copy you want.

```
A>PRINT FILE1.TXT
  A:FILE1    .TXT is currently being printed
A>PRINT FILE1.TXT
  A:FILE1    .TXT is currently being printed
  A:FILE1    .TXT is in queue
A>
```

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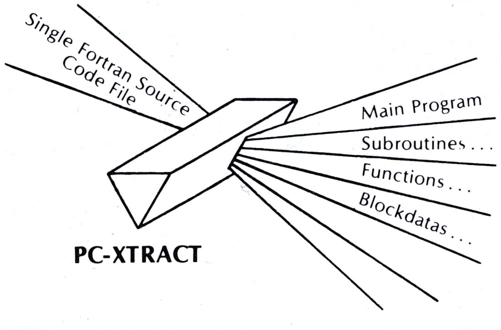

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Of course, while this queue is being printed you are free to run other programs on your PC. You should, however, make sure that any program you run while a background print is in progress works through the operating system. Many programs don't conduct their input and output through DOS but instead bypass the operating system and work directly with the hardware. Therefore, unfortunately, you cannot queue up a whole slew of files to be printed and then sit down to a session on the *Microsoft Flight Simulator* or any other high-performance program.

This raises the issue of how many files can be placed in the print queue. Once the print queue is ten files long, no others are allowed to join it.

More than one filename can be entered on the *print* command line at the same time. For example, to print all four of the files you've created, you can enter

```
A>PRINT FILE1.TXT FILE2.TXT FILE3.TXT FILE4.TXT
```

To make things a little simpler, DOS lets you use wildcard characters with the *print* command. In the example just cited, you can replace the 1, 2, 3, and 4 in the filenames with a single ?. To demonstrate this feature—and to see what happens when the print queue becomes full—try entering the following command three times in quick succession:

```
A>PRINT FILE?.TXT
```

One convenient method of entering a command more than once is to use the F3 key—which repeats the last command entered at the keyboard—and then press enter.

The first time you issue the command, *print* searches the directory and determines that there are four files that meet the wildcard specification. It then places all four files into the print queue.

When you issue a second command, *print* again places the four files in the print queue; there are now eight files in line. On your third use of the command, however, there should be room for only two more files. So *print* adds the first two files it finds that match the wildcard search and then closes the queue. To show that the queue is full, it prints the message

```
PRINT queue is full
```

on the screen and lists the contents of the queue. At this point, it won't accept any more files to be printed until a space becomes available in the queue. The queue itself follows a first-in, first-out sequence.

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A quick look at what you've just done may reveal that you've cost yourself half a box of paper and tied the printer up for a half hour or so. It would be nice if you could stop the printer before you wasted any more paper, wouldn't it? However, while the queue is full you have a good opportunity to see some of the other print features at work.

If you're ever in doubt about what files are in the print queue, or if you're smart and have located your printer in another room and you'd like to check the status of the queue, you can simply enter the *print* command with no argument; doing so will generate a status report on the screen. This might look something like

```
A>PRINT
  A:FILE2   .TXT is currently being printed
  A:FILE3   .TXT is in queue
  A:FILE4   .TXT is in queue
  A:FILE1   .TXT is in queue
  A:FILE2   .TXT is in queue
  A:FILE3   .TXT is in queue
  A:FILE4   .TXT is in queue
  A:FILE1   .TXT is in queue
  A:FILE2   .TXT is in queue
A>
```

showing that DOS has finished printing the first document and is currently working on the second.

Before you waste all that paper and cause severe strain on your printer ribbon, you should learn how to abort the *print* command. The control-break combination has no effect on the *print* command, since it will only affect any other command that is running concurrently. The key is to enter

```
A>PRINT /T
```

Adding the /T switch to the *print* command tells DOS to terminate the process immediately and dump the contents of the queue. *Print* responds by stopping the printout in progress and ejecting the page currently in the printer. It then rings the printer's bell, empties the print queue, and terminates the entire print. It also causes the message

```
All files canceled by operator
```

to be printed by the printer.

Another switch you can use with the *print* command is /C, which cancels the specified files. For example, if you queue all four files for printing using

```
PRINT FILE?.TXT
```

and then decide that you don't really want to print the file named File3.txt, you can enter the command

```
PRINT FILE3.TXT /C
```

and cause *print* to remove File3.txt from the queue. If File3.txt appears more than once in the same queue, it's removed wherever it occurs.

The /P, or print switch, causes all the filenames that precede it to be printed, allowing you to set up complex print situations with a single command. For example, suppose that you want to print the three files named File2.txt, File3.txt, and File4.txt. Rather than entering three different *print* commands or entering a global *print* command and canceling File1.txt (which would be difficult, since the printer will have started to print it already), you can accomplish the whole thing with one command:

```
A>PRINT FILE?.TXT /P FILE1.TXT /C
```

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This will load the three desired files into the print queue and cause the message

```
A:FILE1   .TXT canceled by operator
```

to be printed on the printer.

Unfortunately, the *print* command is one of those innocent little commands that are extremely vulnerable to both deliberate and accidental sabotage. There are many cases where the poor thing becomes incredibly confused because while it is off doing its thing, the operator is free to wreak as much havoc as possible. For example, what happens if you queue a file for printing and then change its name? The best way to see the result is to try it.

Enter the command

```
A>PRINT FILE?.TXT
```

Then change the name of File2.txt as follows:

```
A>RENAME FILE2.TXT SOMETHN.ELS
```

and observe the reaction. *Print* will plod along printing the first file. When it comes to the second file, however, it won't find it. That is, it *shouldn't* find it; for mysterious reasons *print* occasionally does find the file and prints it out correctly. As though to make a mockery of the situation, *print* will on some occasions print out the file, or at least a part of it. Strange goings-on indeed.

All this means, of course, is that it's best not to tamper with any file queued for printing. It's best not to have two processes act on a file at the same time under any circumstances. Since concurrency seems to be a coming attraction on the PC (new versions of DOS are on the horizon), it behooves you to establish good habits now. Otherwise, when you get the opportunity to run several tasks concurrently you'll discover many new and wonderful methods of destroying your work.

There are other things to avoid when you use *print*—besides tampering with queued files. For example, invoking the *print* command and sending information out to the printer via *another* command (such as *type*) can have devastating effects. So too can the use of the printscreen key. The Basic command *llist*, which sends a program listing to the printer, should also be avoided. In other words, don't invoke any command or program that uses the printer while DOS's *print* command is doing its thing.

Here's another caveat: *Print* has trouble with pathnames. Try creating a new directory, called Backup, on your disk. Then copy the filename File2.txt to the new directory and erase it from the root directory. This can be done as follows:

```
A>MKDIR BACKUP
A>COPY FILE2.TXT \BACKUP
  1 File(s) copied
A>ERASE FILE2.TXT
```

Now enter the *print* command to print the remaining three files in the root directory

```
A>PRINT FILE?.TXT
```

Print will queue up the three files and print them in the background as requested. If you now attempt to print the file that you just transferred to \Backup, however, you'll get an error message:

```
A>PRINT \BACKUP\FILE2.TXT
B:          .      File not found
```

For some reason, *print* cannot work in different directories at the same time. The rules for how *print* works on various directories are vague, so just assume that putting the command into a situation where it is forced to work with multiple directories is dangerous. By experimenting, you can discover that if you log on to another directory and issue a *print* command that includes a pathname, you'll get an error message.

Print also ignores the search path set by the *path* command. For example, if you are in the root directory and you set the search path to \Backup and then tell *print* to print a file in that directory, you will be given a "file not found" error message, and the file won't be printed. *Print* does, however, work perfectly when you use a disk drive identifier with two floppy disk drives.

You'll find another interesting "anomaly" if you try to redirect the output of the *print* command to a disk file. Enter the command

```
A>PRINT FILE?.TXT >MYFILE
```

The file named Myfile is actually created. However, the *print* command merrily sends the contents of the specified files to the printer, just as it would if you hadn't asked for redirected output.

When you examine Myfile, you will see that it contains:

```
A>TYPE MYFILE
A:FILE1.TXT is currently being printed
A:FILE2.TXT is in the queue
A:FILE3.TXT is in the queue
A:FILE4.TXT is in the queue
```

Print does not communicate with the printer through the standard output, although its screen messages are all treated as standard output.

On the same track, it is illustrative to send the output of a file through the *print* command and then pipe it to a filter. The *find* filter lends itself well to sending the output of a file through the *print* command. First, copy the file Find.exe to your disk, and then issue the command

```
A>PRINT FILE?.TXT¦FIND "2"
```

Theoretically, this command should pass only the lines that contain the 2. The *print* command will print all four files intact, however. What it does is send its *screen* output through the filter, resulting in the display of only one line:

```
A:FILE2   .TXT is in the queue
```

That's all there is to know about the *print* command. You can do some effective things with it, but it does have one or two limitations. ▲

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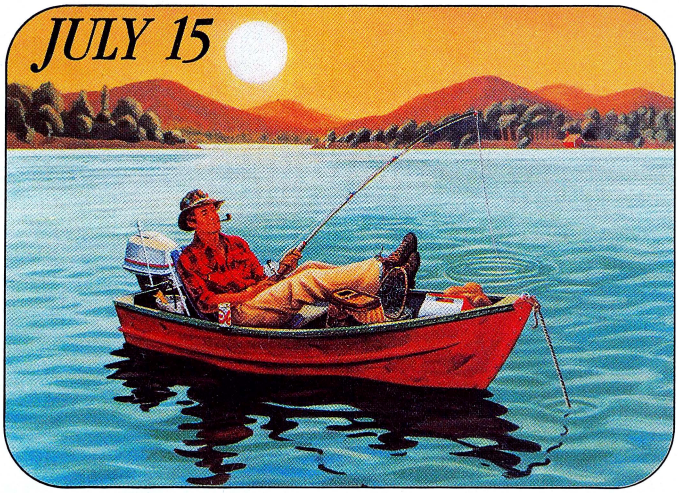

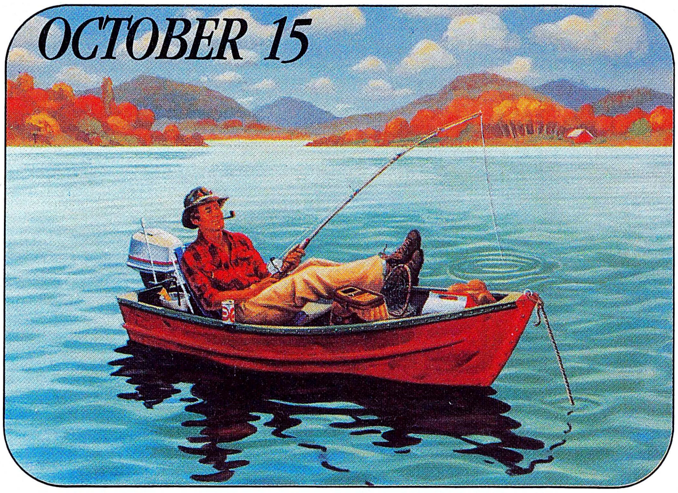

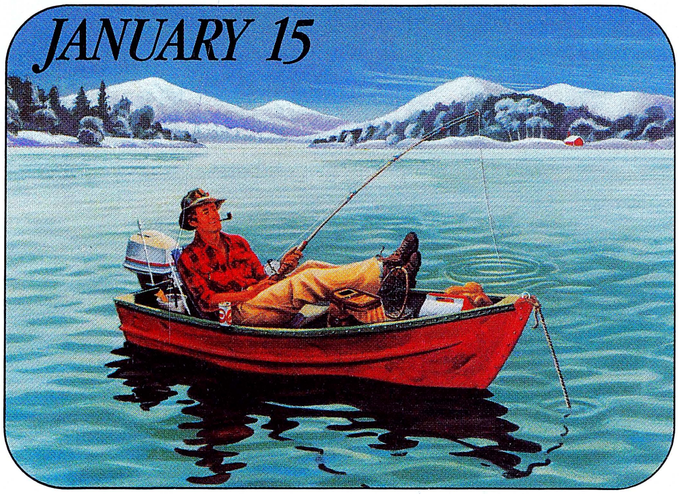

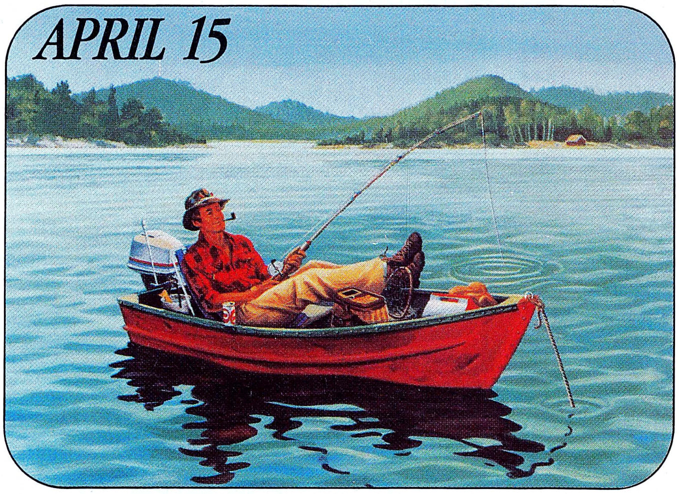

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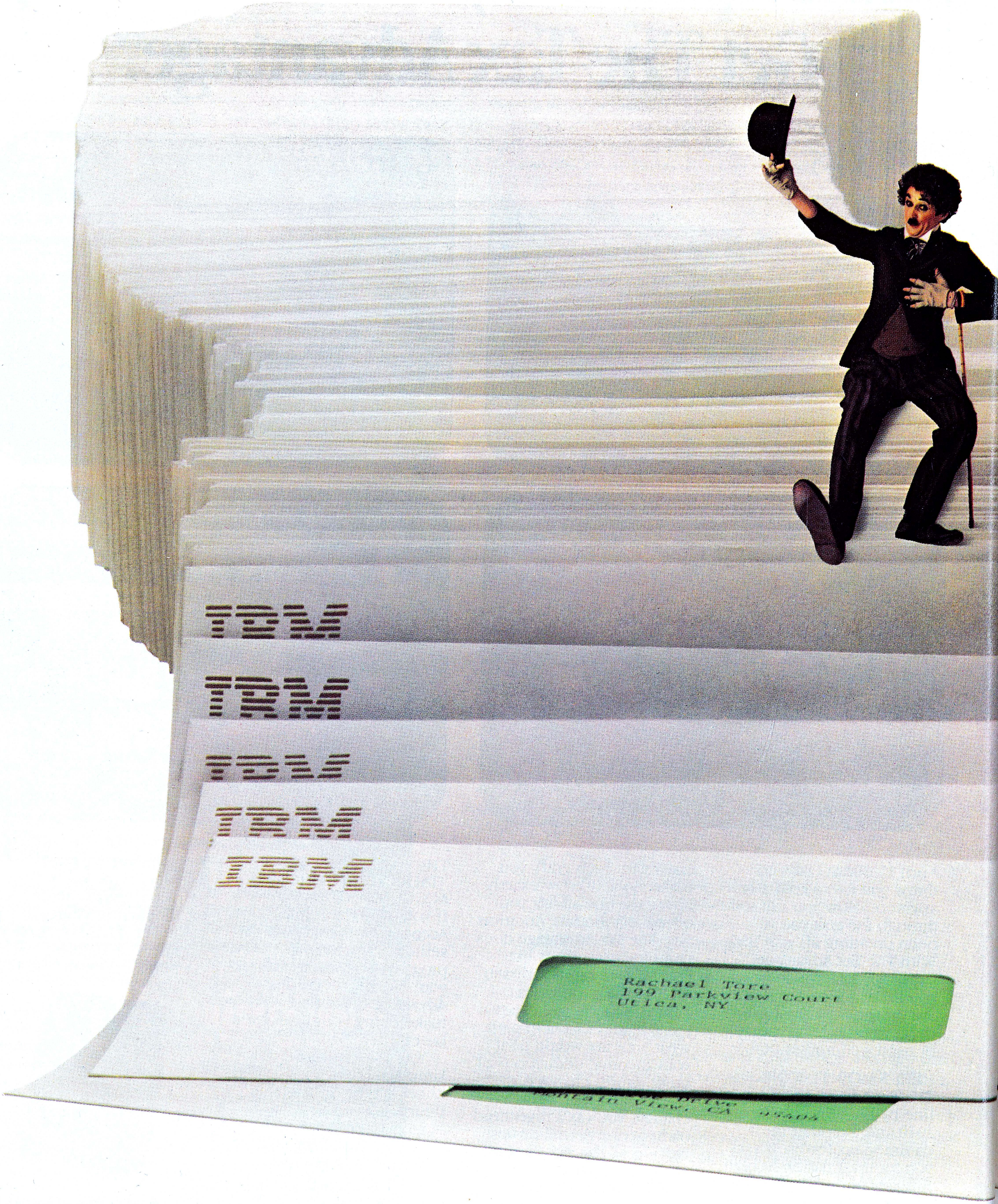
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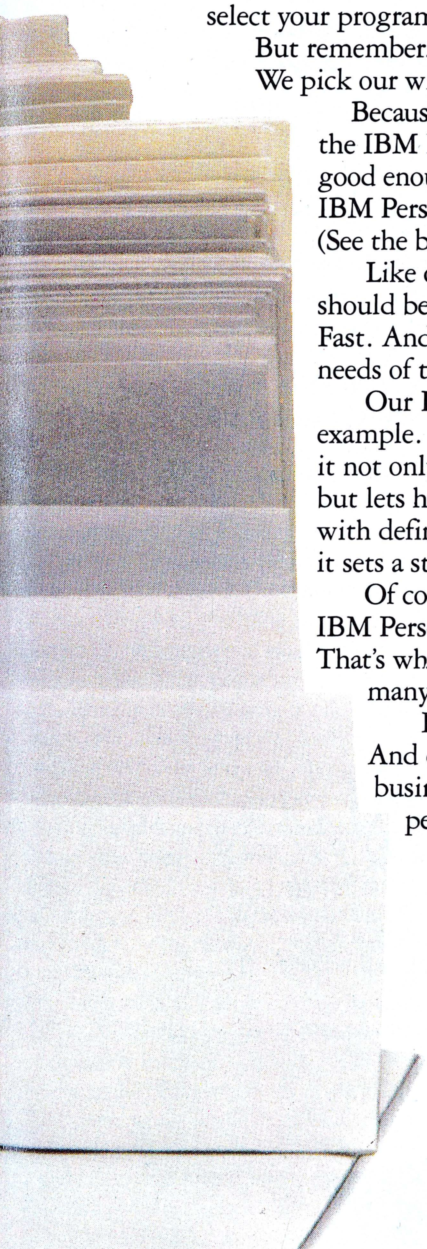

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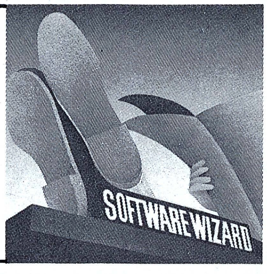

Δ **AST Research** (Irvine, CA) has entered into an agreement with **IBM** (Boca Raton, FL) under which IBM will sell two AST add-on printed circuit boards for the PC—the SixPakPlus and the MegaPlusII multifunction boards—in their product centers and to value-added dealers. "We are pleased IBM considers our quality equal to the task of maintaining the IBM image," said Thomas C.K. Yuen, executive vice president of marketing for AST Research. Δ AST has appointed **Thomas Stickel** vice president of sales, a new position created to sharpen AST's focus on large OEM end users. Stickel comes to AST from Technical Marketing and Sales (Mission Viejo, CA).

Δ **Infocom** (Cambridge, MA) has named **Addison-Wesley** (Reading, MA) as the sole publisher representing *Zork*, *Deadline*, *Planetfall*, and its other interactive adventures to book dealers and distributors in the United States and Canada. "We were impressed by Addison-Wesley's solid reputation in microcomputer book publishing and its commitment to widespread software distribution," said Joel M. Berez, president of Infocom.

Δ **Compaq Computers** (Houston, TX) has announced that **Entre' Computer Centers** will market Compaq portable personal computer products nationwide. Entre' Computer Centers market personal computer products to small-business professionals and Fortune 1000 companies. Δ Compaq has also purchased approximately fifty acres of land adjacent to its corporate headquarters in Houston to accommodate additional manufacturing and office space. The new facilities will be built during 1984.

Δ **Faraday Electronics** (Palo Alto, CA) has contracted with Microsoft Corporation (Bellevue, WA) to supply MS-DOS to the FE Model 64, Faraday's PC-compatible single board CPU. Δ Faraday has also signed a contract with **Esprit Systems** (Melville, NY). Esprit will be using the FE Model 64 as the CPU in its ESP 9310 interactive CRT terminals. Other products using the FE Model 64 to achieve PC-compatibility include Datamedia's Elite PT, Gateway Communications's Gateway File-saver, and Tava Corporation's Tava PC.

Δ **Eagle Computer** (Los Gatos, CA) has announced plans to offer Microsoft *Windows*, an extension to the MS-DOS operating system, and an optional mouse as features of Eagle's IBM PC- and XT-compatible systems. Δ Eagle has also signed a major supply agreement with **ComputerLand** (Hayward, CA). ComputerLand will purchase and distribute the entire line of Eagle PC Spirit portable and Eagle PC Plus desktop series through retail outlets worldwide.

Δ **Microrim** (Bellevue, WA), a producer of relational database software, has also signed an agreement with **ComputerLand** for worldwide distribution of *R:base Series 4000*, a comprehensive relational database management system for the personal computer. *R:base* provides for forty files containing 100 billion records and allows the creation of tables based on the contents of two or more files. Δ **Softsel Computer Products** (Inglewood, CA) has also agreed to distribute *R:base*.

Δ **Byron E. Wicks** has joined **Media Technology Corporation** as the company's first-ever director of marketing. "The naming of Byron Wicks to marketing director is one of our efforts to take a high profile in the Winchester disk marketplace," explained MTC president Don Mattson. Wicks's immediate concerns are with MTC's new 5 1/4-inch thin-film-coated hard disk. "We are stepping into a fast-growing, potentially lucrative, and very competitive market," says Mattson. "Byron's record at IBM, Memorex, Xerox, Fujitsu, and most recently Qume, brings a certain marketing punch to MTC."

Δ **Lotus Development Corporation** (Cambridge, MA) has signed an agreement with **Citibank** (New York, NY) that will make *1-2-3* available through *CitiIntegrator*, part of Citibank's new microcomputer-based treasury management system. *CitiIntegrator* automatically retrieves and consolidates balance information from customers' reporting banks, calculates target balance data, and provides access via an XT to Citibank's global electronic banking, cash management products, and online databases.

Δ The **Subcommittee of the American National Standards Committee 239**, a standards-developing organization for library and information sciences and related publishing practices, has agreed on the format of the number to be assigned to software for microcomputers. Each distinct software item for sale will be identified by a number indicating the registrant, the product, the delivery medium, and a check digit. Subcommittee chairperson David Cohen of Technique Learning Corporation reported that "we spent a great deal of time defining each component of the number to provide the maximum flexibility and the minimum 'look up' for the user. The standard will recommend and define certain elements of bibliographic data that should become part of every program description."

Δ **David Collopy** has been appointed as a senior editor of *Business Computing* (Littleton, MA), a publication directed at users of IBM and IBM-compatible personal computers in organizations ranging from small businesses to Fortune 1000 companies. Prior to joining *Business Computing*, Collopy wrote for industrial and consumer publications focusing on specific computer applications in the business environment. He has also written user documentation for computer software products. Δ **William E. Suydam, Jr.** was also named a senior editor of *Business Computing*. Suydam was formerly

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technical editor of *Popular Computing* and was responsible for a variety of writing and editorial functions.

Δ **Brown Disc Manufacturing** (Colorado Springs, CO), producer of high-density floppy disks, has completed a private placement of 1.5 million shares of convertible preferred stock. Proceeds totaling $6.6 million will be used for general corporate purposes, including expansion of the company's marketing program and sales force. The two-year-old firm manufactures linear-coated 5 1/4-inch floppy disks ranging to ninety-six tracks per inch and spin-coated disks handling up to two hundred tracks per inch.

Δ **BASF Systems** (Bedford, MA) has agreed to buy an eighty-thousand-square-foot manufacturing facility near its main plant for the sole purpose of manufacturing floppy disks. There are additional plans to build a larger cleanroom environment for FlexyDisks, BASF's brand of floppy disks.

Δ **ComputerCraft Learning Centers** (Houston, TX) has selected **Interactive Research Corporation**'s (Santa Clara, CA) IRC laser videodisc-based IBM PC training system for use in its instructional centers. Burdette Hanson, president of IRC, said the agreement calls for six IRC systems to be installed in ComputerCraft's flagship training facility in Houston. The centers train approximately fifteen hundred individuals per month, including clients from Exxon, General Mills, Deloitte, Haskins & Sells, and Tenneco.

Δ **The Small Computer Company** (Ridgewood, NJ), a software developer, has stopped **Group G Industry Consultant Corporation**, a New York City area consulting firm, from selling bootleg copies of its computer software products. U.S. District Judge Richard Owen issued an injunction prohibiting Group G from selling the illegal software. "Software developers have found themselves virtually powerless to prevent a burgeoning trade in bootleg software," said The Small Computer Company president Howard Wolowitz. "We want to make Group G pay the full price for every illegal copy that was made. And we want this to be a message to other software pirates all over the country."

Δ **Hayes Microcomputer Products** (Norcross, GA) signed a patent licensing agreement with **Bizcomp Corporation** (Sunnyvale, CA). The patent, issued in June 1983, protects basic techniques used to control command-driven modems, including the Smartmodem 300, Smartmodem 1200, and Smartmodem 1200B. Stated Hayes president Dennis Hayes, "There are several modem manufacturers competing in the microcomputer industry that have made advertising claims that some of their products are the equivalent of Hayes Smartmodems. If these products truly operate like the Hayes products, they may well fall within the claims of the patent and, accordingly, these companies may be affected by the issuance of the patent. We wanted to clear any doubts about our product design and get on with business."

Δ **Raging Bear Productions** (Corte Madera, CA), the producer of the National Software Show, canceled their NSS East show, which would have been held this month in Miami Beach. "Although the NSS East booth sales were following our projections," stated David Russell, president of Raging Bear, "our research confirmed two blatant problems with microcomputer shows: There are too many, and there is a lack of service to exhibitors and attendees by the majority of show producers. Service, through sensitivity and an understanding of the dynamics of the marketplace, remains our primary goal."

Δ **Arrays, Inc.** (Los Angeles, CA) filed a registration statement with the Securities and Exchange Commission relating to a proposed initial public offering of 1,525,000 shares of common stock. Net proceeds from the offering will be used for the acquisition and development of new products, increased advertising and promotion, expansion of facilities, and working capital. Arrays publishes and markets personal and small-business software and books related to microcomputers.

Δ **Software Arts** (Wellesley, MA), creator of *VisiCalc* and *TK!Solver*, has appointed **Dr. Milos V. Konopasek** as senior scientist. Dr. Konopasek will lead the ongoing development effort for the *TK!Solver* line and will report to Stephen M. Bayle, senior manager of product development. "Milos Konopasek proposed the development of the *TK!Solver* program as a consultant to Software Arts and has been actively involved in making this new product a reality," Bayle said. "We are delighted he has joined us full time."

Δ **Chalk Board** (Atlanta, GA), which has introduced PowerPad, a touch-sensitive tablet, and *Leonardo's Library*, a comprehensive set of learning/discovery software packages used in conjunction with PowerPad, has received $4.6 million in financing from major venture capital firms and private investors. The new financing will be used for production, further development work, and extensive marketing activities.

Δ **Timothy H. Kennedy** has joined **BankPro Systems** (San Francisco, CA) as vice president of marketing and will be responsible for developing and implementing a long-range marketing strategy for BankPro. BankPro's first product, an automated funds-transfer system based on the PC, was introduced at the Bank Administration Institute's Money Transfer Developments Conference. ▲

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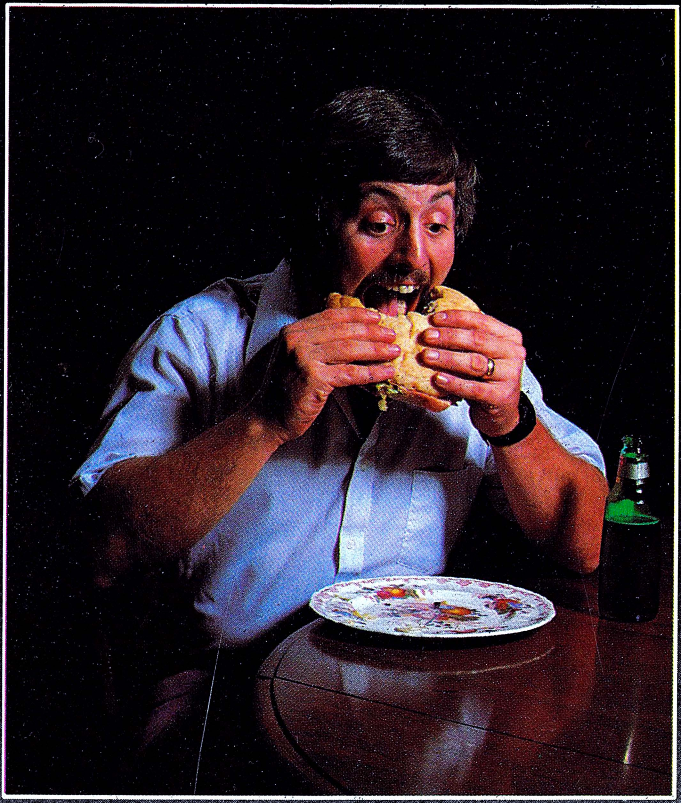

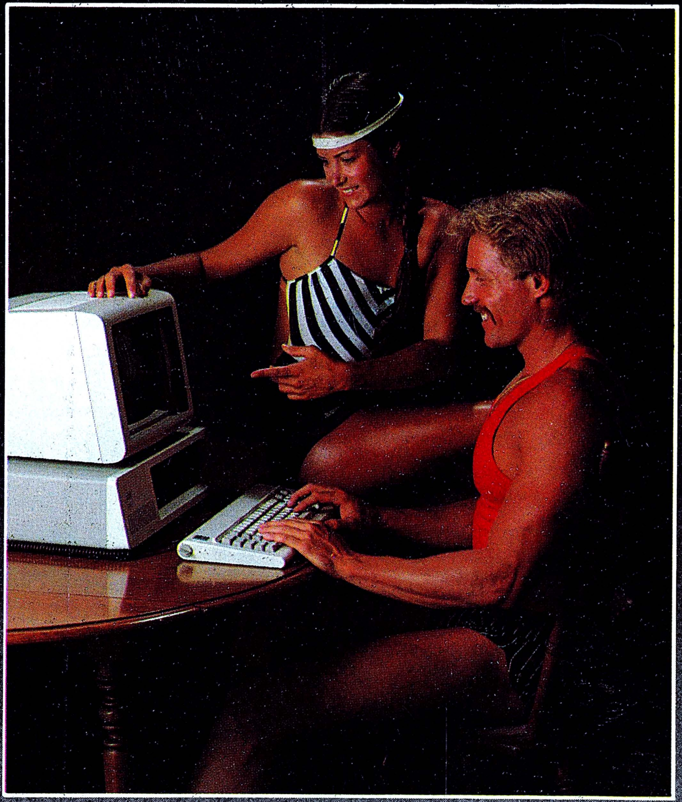

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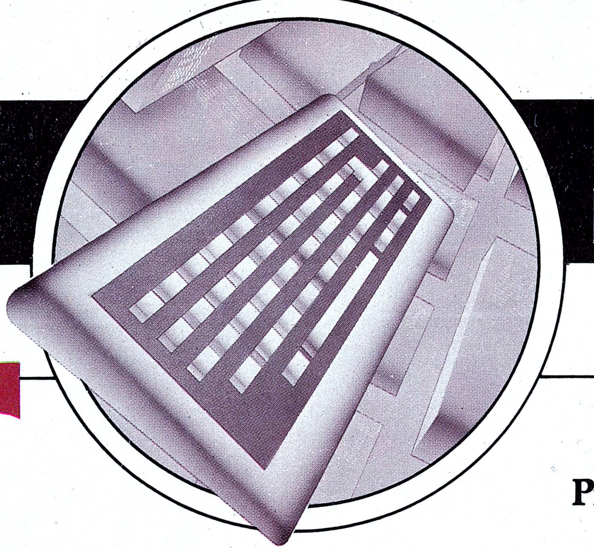
BEGINNERS' CORNER

by Kathy Talley-Jones



Preparing for Junior

This month "Beginners' Corner" begins again—with a new emphasis: PCjr. Since Junior is IBM's first computer aimed specifically at the home market, we'll devote this initial installment to a survey of uses to which a high-quality home computer might be put.

Meet the Barrett family.

Jane and Kevin Barrett have just purchased a PC*jr*—they decided it was time they brought a computer into their lives. They haven't yet learned everything there is to know about computing, but they do have ideas about what they want in a home computer. Jane uses a PC at work—mostly *1-2-3* and sometimes *Multiplan*—so she has at least some familiarity with IBM microcomputers, but not much.

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Kevin and Jane's kids, Marjory and Jack, have been excited by their friends' PCs and the games they play on them: *Crossfire*, *Enchanter*, and *Frogger*. They've been pressuring their parents to get a computer, and, naturally enough, the Barretts see having a Junior as a potential way to widen their children's experience: to make them comfortable with computers (Jane is only too ready to describe her terror when first confronted with her PC at work), to enhance their math and reading skills, and to exercise their logic and creativity. Marjory's sixth grade teacher—Jack is in kindergarten—has also hinted that the school system may soon acquire a few Juniors.

As a hobby, the Barretts distribute a few records made by local folk singers and musicians to larger independent distributors; their company operates under the name Calamari Distributors. They've kept muddled records in account books and on three-by-five cards for the last few years, but now that they have an inventory of ten different albums they need a more sophisticated way to keep track of what they've sent to whom, which magazines and writers have received review copies of what, and what radio stations have what records on their playlists. Calamari Distributors has always been a labor of love, but a surprise profit of a few thousand dollars in 1982 (and the IRS's subsequent interest in Calamari) has convinced Kevin and Jane that they need to become better organized.

While researching the Junior and looking over the catalog of IBM software available for it, the Barretts discovered that there are essentially seven kinds of application programs. The Barretts don't know much about the machinery yet, but they do know that application programs are the means by which to use the computer and make it work for them. The types of applications available are educational software, games, graphics, spreadsheets, databases, word processing, and communications. The family can all learn some programming languages later; for the moment they want to get as much fun and profit out of the Junior as they can with as little effort as possible.

Because the Barretts have some business applications in mind, they decided to buy the more expensive extended version of the Junior—the one with the disk drive, which will store Calamari Distributors' business information on floppy disks. The extended version will also allow Marjory and Jack to borrow some of their friends' PC games and run them on Junior. They realize that some PC games may not work on the Junior, but there are plenty that do to keep things exciting.

Education. Although Jack and Marjory are bright, their parents feel that kids' basic skills could use improvement. They've observed that a computer can seem like a patient, nonjudgmental tutor to children—it won't criticize them when they get an answer wrong and won't become impatient when they repeatedly make mistakes on the same kind of problem. The computer will also provide opportunities to try a problem or practice a skill over and over again.

The Junior's education application software can help preschool children learn the relationship of things in space (left and right, forward and backward, up and down, and so on), improve hand-eye coordination, and prepare them to learn arithmetic and reading when they go to school.

To build math abilities, the software available includes *Adventures in Math*, *Arithmetic Games*, *Bumble Games*, and *Monster Math*. These games introduce children to numbers and to arithmetic concepts such as addition, subtraction, multiplication, and division, help them build arithmetic skills, and provide an entertaining arena for practice.

As Kevin and Jane noticed, most of the educational software for the Junior is designed to enhance math skills. *Juggles' Butterfly*, however, is something of an exception; like an interactive *Sesame Street*, it teaches children elementary spatial concepts, letters, and numbers through the use of keyboard overlays,

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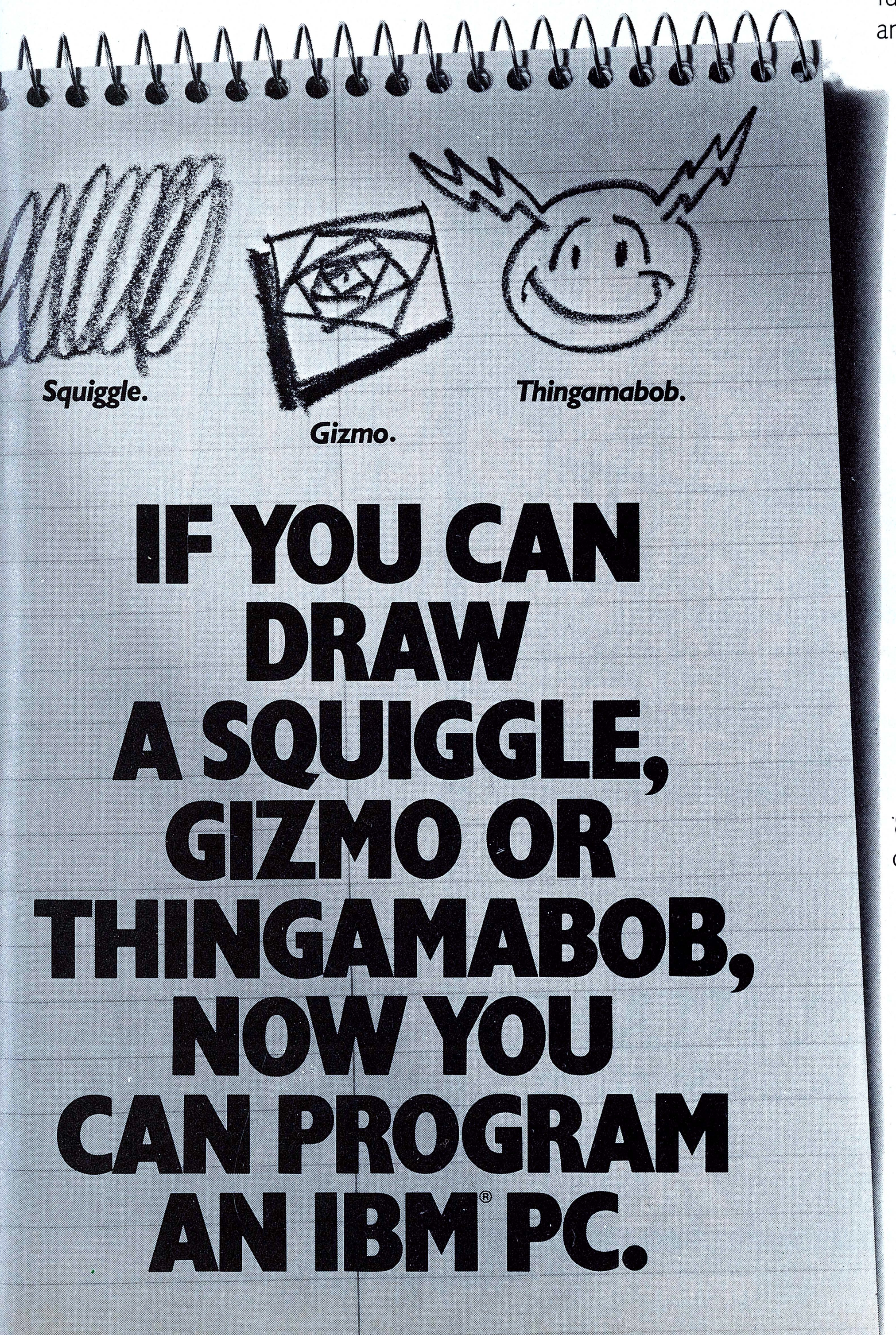
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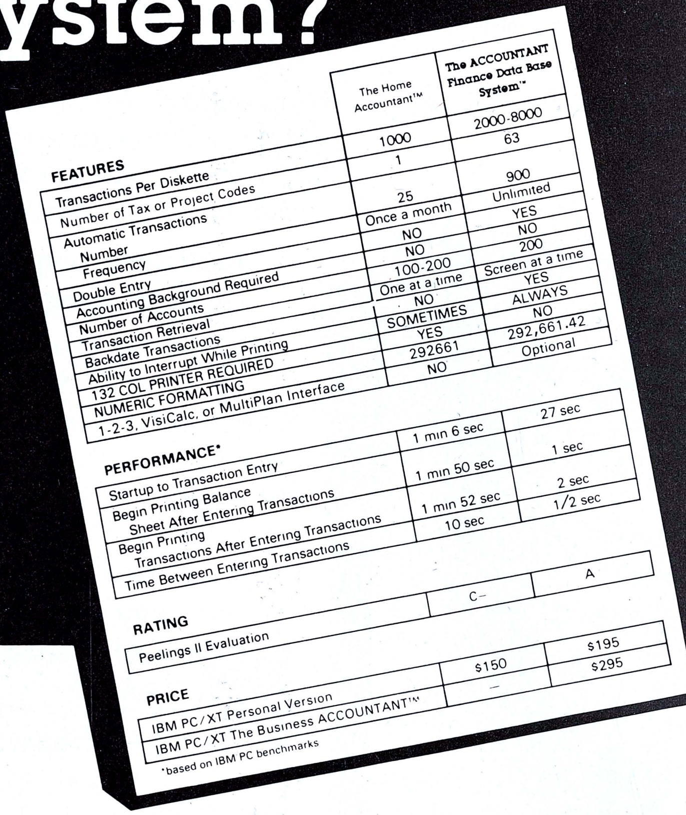

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As a computer novice and accounting illiterate, I set out to make a home finance program my first major software purchase. I fear *Softalk's* Fastalk column led me astray.

The Home Accountant is called "thorough and powerful." *The Accountant* is more expensive and gets modest descriptions like "simple-to-use" and "a sleeper." The choice should be obvious.

In fact, I believe *The Accountant* (the more expensive program) is so far superior as to justify the cost. It gives the user credit for brains but will handhold you through a remarkably effective double-entry system. That part might scare people off. In fact, it makes this program more enjoyable, as well as being educational and practical, but not more difficult. The documentation and tutorial are excellent, and Decision Support Software gives excellent user support.

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music, and color. There is also software, such as *Animation Creation*, that allows children (and adults, of course) to create graphic images with which to animate their own pictures; and there's *Turtle Power*, which allows children to create pictures by moving a vaguely turtle-shaped pointer around on the screen by way of keyboard commands. There's also a wealth of PC educational software that will work on the Junior, provided it doesn't need two disk drives or more than 128K of memory.

Games. Games can help beginners acquire ease and familiarity with the computer that will not only build computer literacy and confidence but also encourage creativity. The Barretts don't want their kids to feel as threatened by computers as they were, so they don't feel that time spent playing *Adventure* is time wasted—at least, not yet.

Crossfire, which, as we've seen, already interests Marjory and Jack, is an arcade-type game available on the Junior. You use the keyboard or joystick to direct extermination efforts against giant bugs that are attacking a city. This is a variation on the shoot-'em-up-type games populating shopping mall arcades. *Mineshaft* and *ScubaVenture* are also Junior arcade games; both have the player hunting for treasures.

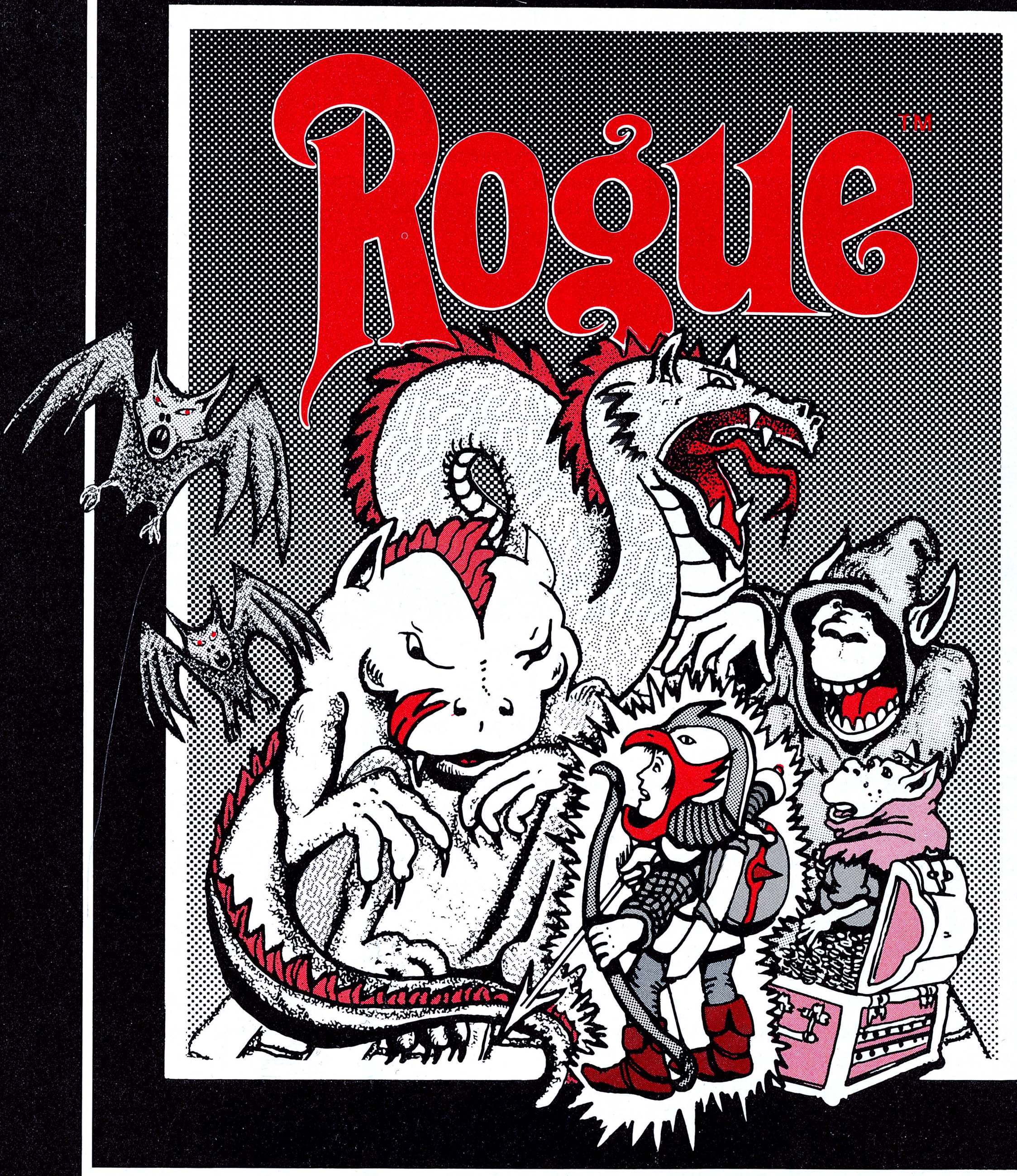
Another variety of game is the adventure, which is prose-based and allows the player to interact in writing with the program. The program describes a room or a character or an event, and the player must respond appropriately by directing exploration, answering a riddle or solving a puzzle, or speaking to some character in the game. These games have become very witty, complex, and addictive. Some of the games marketed by Infocom and playable on the Junior—such as *Zorks I, II,* and *III, Planetfall, Deadline,* and *Infidel*—have become renowned for their stories.

There are also games that simulate existing board and card games. The IBM *Casino Games* are one example of this genre. Kevin is looking forward to acquiring this package, because he's a hot blackjack player from way back.

Graphics. Graphics application software allows you to create moving graphics, three-dimensional graphics, and your own games. As the Barretts have discovered, Junior's *Turtle Power* lets users manipulate a turtle to create graphics on the screen. *Turtle Power* graphics are mostly for play, but other graphics software lets you design your own pie charts and bar graphs.

Jane and Kevin also bought their little PC in hopes of furthering the reach of Calamari Distributors.

Spreadsheets. Two spreadsheet programs, *VisiCalc* and *Multiplan*, are available from IBM to run on the Junior. Spreadsheets are financial planning and analysis tools; by elec-



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tronically simulating an accountant's worksheet and performing mathematical and financial functions, these programs will replace Calamari's ragged account book and the Barretts' old TI calculator.

A spreadsheet program is designed to simulate an accountant's pad, typically offering some 254 rows and 64 columns, scrolling sideways, upward, or downward. Cells are formed where the rows and columns intersect; they're identified by row and column numbers. The cells can be filled with text, numbers, formulas, and special functions. The programs are designed so that you can change information in one cell of the worksheet and have all related cells updated automatically.

Kevin and Jane are likely to find their spreadsheet program very useful for Calamari Distributors because it will let them speculate on a course to take, manipulate the worksheet to reflect their ideas, and come up with financial projections. For example, if they buy and distribute one thousand copies of Ted Barton's *Bells over Mbabane*, they'll have enough profit to take on distribution of Jill Halsey's *Time Stood Still*, a record they greatly admire. Because their spreadsheet program will allow them to see these relationships more clearly, it will help them project Calamari's future with greater confidence.

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Databases. Databases are more properly known as database management systems. A database management system is a filing system that can be indexed in a number of ways. The Barretts will use *PFS:File* to keep a log of a record's year of release, artist, record company; the type of music of each record; the person to whom the record has been sent, and so on. This program formats the data for display onscreen and for printing, listing up to sixteen columns of data defined and filled in by Kevin and Jane. *PFS:Report* generates printed output based on this information.

Word Processing. Word processing application software allows you to write a letter, an article, or a novel (using the keyboard) and see your text displayed on the monitor screen; you can then store what you've written in memory and transfer it to disk for more permanent storage. Thus you can write a letter, save it and ruminate over it, look at it again on the next day, and handily rearrange and edit it. When the letter is ready to send, you can print it in whatever manner you wish—double-spaced, single-spaced, with wide margins, with narrow margins, or whatever.

Jane and Kevin can obviously find many uses for their word processing package; they can use it to write business letters and short notes to one another and to format brochures. Because neither of them has ever used a word processing program before, they have decided to buy *HomeWord*, a program that uses graphics to introduce word processing concepts. Marjory will also use *HomeWord* to prepare reports for school and write letters to her out-of-state grandparents.

Spreadsheet, database, and word processing programs require a machine equipped with a disk drive so that information and records can be stored on floppy disks.

Communications. The Junior can be equipped with a built-in modem, which facilitates the transmission of information electronically over telephone lines to another computer. Communications software is needed to work with the modem; the software can direct the computer to dial the number to be called (you don't need a telephone, just a working telephone jack) and to communicate with the device on the other end.

Jane and Kevin are going to purchase IBM's *Personal Communications Manager* to use with their modem. One of the big independent record distributors in New York has a modem, and the Barretts expect to communicate with this distributor about the releases, prices, and stock status. They're also going to subscribe to The Source, an on-line service that gives subscribers access to useful information and allows them to communicate with each other.

Next month: a look at the PC-DOS operating system—software that helps the PCjr function and that holds the hardware together. ▲

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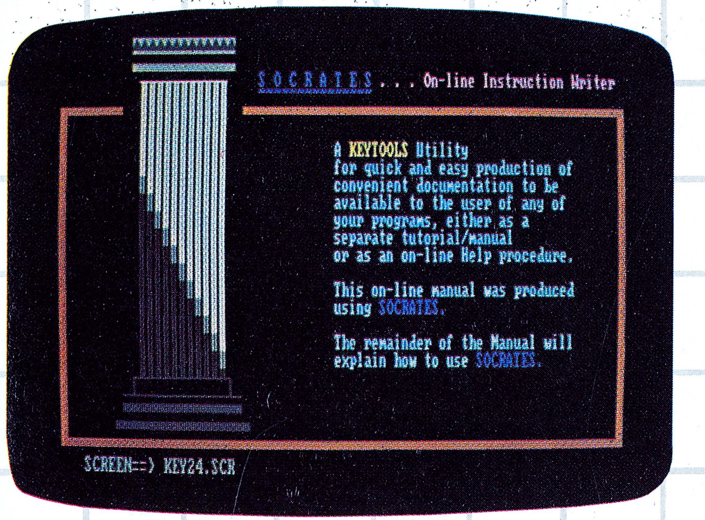

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SCREEN==> KEY24.SCR
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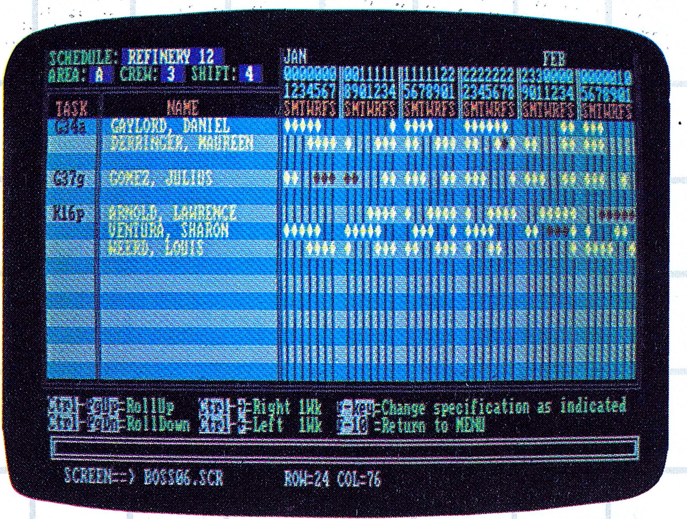

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SCHEDULE: REFINERY 12          JAN                                      FEB
AREA: A  CREW: 3  SHIFT: 4     0000000 0011111 1111122 2222222 2330000 0000010
                               1234567 8901234 5678901 2345678 9011234 5678901
TASK        NAME               SMTWRFS SMTWRFS SMTWRFS SMTWRFS SMTWRFS SMTWRFS
G34a   GAYLORD, DANIEL
       DERRINGER, MAUREEN

G37g   GOMEZ, JULIUS

K16p   ARNOLD, LAWRENCE
       VENTURA, SHARON
       WEERD, LOUIS

Ctrl-PgUp=RollUp    Ctrl-→=Right 1Wk  F-key=Change specification as indicated
Ctrl-PgDn=RollDown  Ctrl-←=Left  1Wk  F-10 =Return to MENU

SCREEN==> BOSS06.SCR          ROW=24 COL=76
```

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SOFTWARE REVIEW

A MANUFACTURING SYSTEM FOR THE PC

BY JAN B. YOUNG

Have you looked for an American-made radio in your department store lately? Chances are you won't find one, because radios are no longer manufactured in the United States. On the other hand, look at a hardware store's selection of electric drills. You probably won't find any imports.

Why the difference? Because in the 1960s, Black and Decker, the leading maker of electric drills, successfully implemented an outstanding computerized manufacturing system and became so efficient that the imports couldn't compete.

Used properly, a computerized manufacturing system supports far more detailed and complete planning than is possible by hand. Such a system can accurately track the activity in a factory and provide measurements and controls that are otherwise not possible. The result can be happier customers who buy more and a shop that operates with less confusion, worry, and delay.

Computerized manufacturing systems, originally written for mainframes, began appearing on interactive minicomputers in the mid-1970s. Now, in the mid-80s, they're starting to show up on microcomputers, including the IBM PC.

Manufacturing systems for microcomputers dramatically reduce costs and make computer-based planning and control available to the small manufacturer for the first time. Mainframe systems typically cost \$300,000 to \$1,000,000; microcomputer systems, while necessarily less powerful, incorporate the same basic functions and sell for \$5,000 to \$25,000.

The availability of *MRP-II* (from Twin Oaks Software) for about \$3,000 means that a manufacturing system is now within the reach of the small manufacturer. This article will review *MRP-II*. But first, a little more about manufacturing systems in general—and about materials requirement planning (MRP).

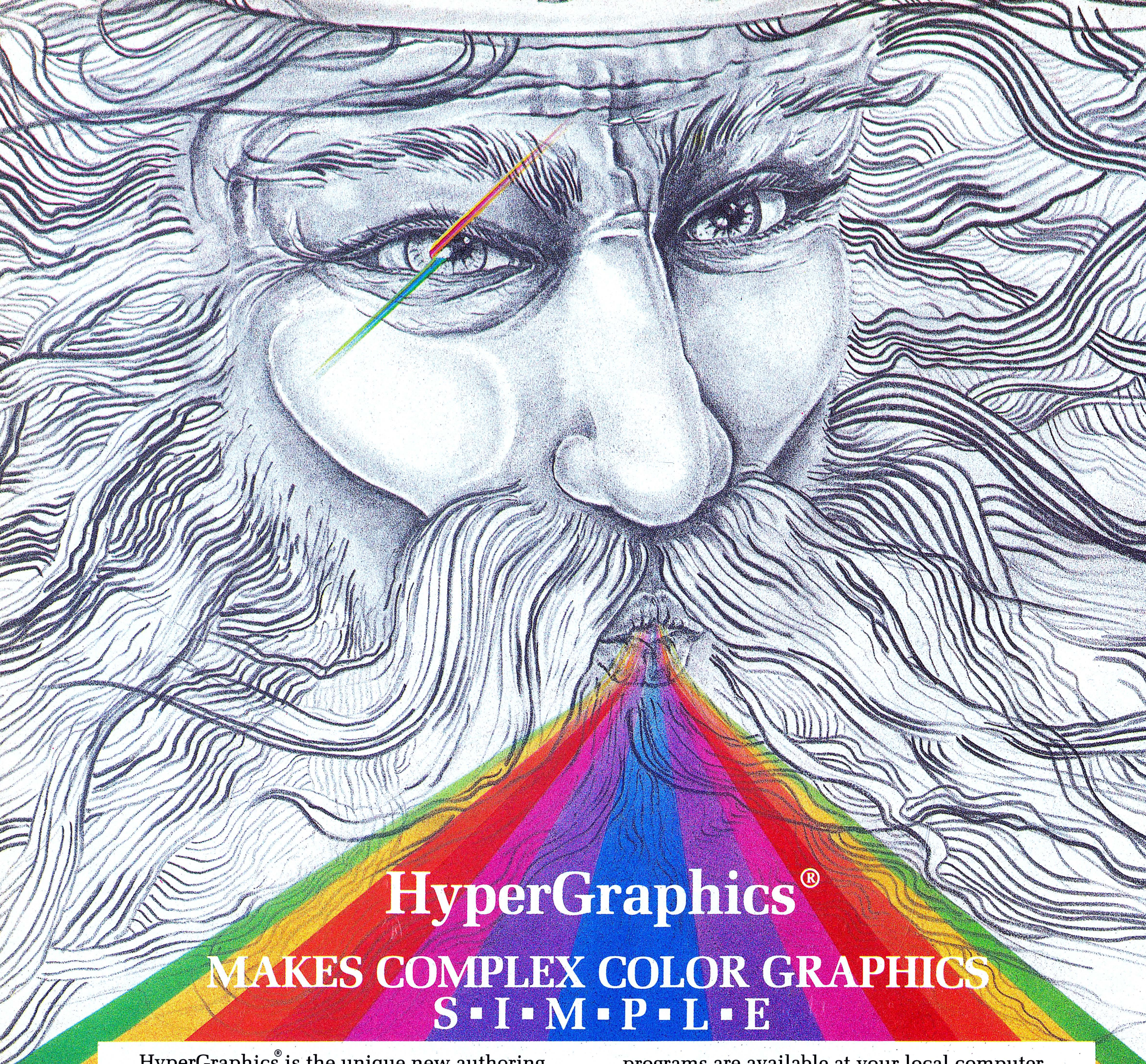
A typical full-scale manufacturing system keeps track of a very large amount of information, including:

- purchased parts and materials, subassemblies, and finished products;
- bills of material—lists of the parts and raw materials used to make subassemblies and finished parts;
- orders from customers, dealers, distributors, and others for finished products and for spare and replacement parts;
- orders placed with suppliers for production materials, office supplies, and all the other things required to run the business;
- inventories on a part-by-part and location-by-location basis;
- employees in the shop;
- equipment used to make the product, including machines and tools; and
- production methods and employee instructions.

A large manufacturing company's information can occupy hundreds of megabytes of disk space. A manufacturing system organizes this data and makes it accessible to the people who need it. Sometimes access takes the form of simple retrieval; at other times it involves complex analysis and many calculations.

Manufacturing systems must also help managers plan; manufactur-

Illustration by Weldon O. Lewin



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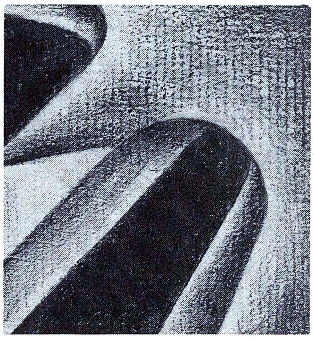
For more information call or write: HyperGraphics® Corp. 100 N. Central Expry. Suite 1208, Richardson, Texas 75080 (214) 783-9900 ing businesses must schedule production, for instance, so that required materials can be ordered in advance and be on hand when needed. Companies must also plan to have adequate quantities of their finished product on hand to meet customer demand; they must have enough equipment, enough trained workers on the payroll, and so on. Manufacturers must also be careful not to have too much of their product around; idle capacity is expensive, and competition demands that unnecessary expenses be ruthlessly eliminated. Good systems pay their way by allowing manufacturers to operate with less waste.

Many manufacturing systems use *material requirements planning*, or *MRP*, a method for planning future work and prioritizing current work so the factory can give its customers the best possible service at the lowest possible operating cost.



MRP works something like this: If a company receives an order for one hundred tidgews and has thirty in stock, it should plan to make seventy more. If there's enough raw material on hand to make twenty tidgews, then additional raw material should be ordered for fifty more. MRP systems perform these simple calculations and determine the timing of each required shop and purchase order to minimize inventory investment. When a business is small and easy to control, management can plan by hand. As a business grows, however, the computer becomes necessary.

Manufacturing systems differ from other business systems in two important respects.

First, they are enormous. A complete mainframe manufacturing system can involve more than half a million lines of program statements in several hundred individual programs. Squeezing this much logic into a PC is difficult, but possible, and the result can be effective for a small manufacturer.

Second, manufacturing systems differ from other business systems in that they cut boldly across organizational lines. For instance, simply keeping track of the number of left-handed whoosits in inventory requires the cooperation of many people. The engineering department defines the part and its characteristics to the computer, the purchasing department tells the computer when orders are placed for the part. The receiving department, the inspection department, the stockroom, the factory workers who carry the part from place to place, and the shipping department all affect the computer's view of how many left-handed whoosits are in stock. Everyone must cooperate to give the computer system an accurate view of what's going on. If the computer has inaccurate or incomplete information, management can't do a good job of planning and running the business. So, how people are trained to use the manufacturing system is critical to the system's success.

New manufacturing system installations can require a fundamental change in the way a company operates. Properly implemented, a system becomes as much a part of a business as its switchboard. However, companies that once were successful have closed their doors because they trusted a manufacturing system to solve their problems for them and didn't adequately train their employees to work with it.

On the other hand, there are lots of success stories proving that manufacturing systems can deliver important benefits. Black and Decker is a case in point.

MRP-II

Starting up a manufacturing system usually takes a long time, because the system involves so many people and so much data. During the installation, the business, the company's markets, and the general economy continue to change. As time goes by, the software evolves with new releases from the vendor, and, after a year or so, the original system may be virtually unrecognizable. Evaluating manufacturing system software is therefore often at least partly a matter of forecasting the future.

There are three important questions to ask when evaluating manufacturing system software: Is the software complete and powerful enough to do the job that needs doing today? Is the fundamental design good and can it be extended to do the job that will need doing tomorrow? Will the technical support needed to modify and operate the system be available both now and in the future?

MRP-II is not a complete system by anyone's standards; several major subsystems have yet to be released. However, the current subsystems, including the control file subsystem, the item master subsystem, the bill of material subsystem, the inventory control subsystem, the pick list subsystem, and the purchasing subsystem, are adequate; the standard cost development subsystem is outstanding.

To use the system, you must have a PC or XT equipped with 128K (256K for the soon-to-be-released MRP subsystem), an eighty-column monitor, and a 132-column printer. You must also have either two double-sided disk drives, or one double-sided floppy drive and a hard disk. *MRP-II* was designed specifically for the PC and XT and appears to be the only manufacturing system that will operate without a hard disk. Companies looking for the least expensive alternative to manual systems may wish to take this fact into consideration.

If speed and convenience are crucial to you, however, a hard disk is recommended. *MRP-II* works with the XT's hard disk, and Twin Oaks says the system also operates with Corvus and Tall Tree drives. You'll also want a relatively speedy printer and a printer buffer, since the system does a lot of printing. A standalone buffer is probably preferable to one that uses internal memory, because some internal buffers appear to interfere with *MRP-II*'s handling of long reports.

Disk size alone limits system capacity. A two-disk system allows *MRP-II* to handle six hundred to seven hundred part numbers, assuming you use the entire released system. Complex bill-of-material relationships or extensive use of multiple storage locations will tend to reduce file capacity. The installation of additional subsystems will require more storage space, reducing capacity further. Of course, a hard disk will greatly increase capacity.

MRP-II is driven by menus and transaction-oriented screens. The menus are only two levels deep and are easy to understand and use. Unfortunately, they fail to recognize lowercase characters. This inconvenience is minor, but a simple program to poke the caps-lock key at the start of each session would have eliminated some frustration.

Twin Oaks has included a batch input feature. According to the manuals, this feature permits transactions to be formatted by another system or transferred to the PC from another computer, and then to be processed by *MRP-II*. We didn't test the batch input feature for this review.

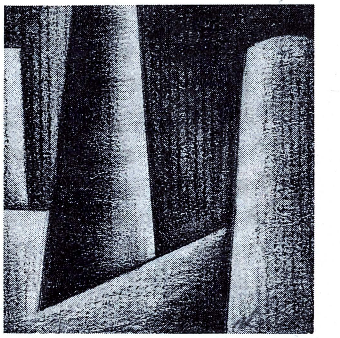
MRP-II uses a single random-access data file for everything it stores. As a result, backups are simple and unused file space can be shared among many subsystems, giving you greater total flexibility. Backup, restore, and rebuild utilities are included as a standard part of the system.

MRP-II limits the user to twenty levels in the bills of material, and a thousand parts on a pick list. These limits are high enough for any Fortune 500 manufacturer and should not be considered a hindrance.

All database changes are recorded on the printer and written into a transaction log. These audit trails are an excellent example of the sound basic design of *MRP-II*. You should file the printouts in date-and-time sequence; if questions or problems come up, these printouts will be an excellent resource both for you and for Twin Oaks.

Manufacturing systems are often used to store confidential and proprietary information; manufacturing system vendors, therefore, ought to provide some way for you to prevent unauthorized access to the programs and data. Unfortunately, *MRP-II* does not include any form of access control. Your only option is to put the PC in a locked room at night and keep the disks in a safe when you're not using them.

Installation. The installation process is the most discouraging and least professional aspect of *MRP-II*. The problem is the manual; the programs themselves work well, but the instructions for installing them are terrible. Twin Oaks omits essential details such as telling you to format twelve disks before starting. The instructions include at least one outright error and use special terminology without explanation.



But don't give up. Difficult and frustrating though it may be, the installation can be accomplished and even understood. Furthermore, Twin Oaks promises help via telephone. Luckily, you install the system only once, and the manual's lack of clarity is unlikely to be a long-term headache.

Control File Subsystem. The control file subsystem must be installed first because it maintains a small file of information that in effect customizes *MRP-II* to the user's requirements. The control file contains, among other things, the user company name for report headings, the desired precision for cost data, and default values for lead times. Once these things have been established, it's reasonable to expect that there'll be little need to change the control file.

Like the installation program, the control file program is unprofessionally programmed, but, fortunately, these programs are infrequently used. Twin Oaks' control file maintenance program appears to be the same program that's at the heart of the installation procedure. Consequently, it suffers from similar problems.

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Item Master Subsystem. Like all other manufacturing systems, *MRP-II* requires that the user provide part numbers for every raw material, fabricated part, subassembly, and finished assembly that the system needs to know about. *MRP-II* permits the use of alphanumeric part numbers and provides space for recording item descriptions, units of measure, make-or-buy codes, drawing numbers, and the initials of the engineer and planner responsible for the items. In addition, the user enters codes that tell the system how to plan an item's inventory and what a part's engineering status is. All in all, the *MRP-II* item master is typical of most manufacturing systems. The maintenance programs operate smoothly and, with a bit of practice, a typist can enter information at full speed.

Deleting an item from the item master requires that several codes be set to specified values and that bill of material linkages be deleted first. The need to delete the bill of material linkages is a technical necessity as well as a sensible restriction, but the need to change, for instance, the engineering status code to *obsolete* before deleting the part is a minor nuisance.

Bill of Material Subsystem. Low-level codes in the bill of material subsystem identify the relative level of assembly of parts. These codes allow programs to start at the bottom of the bills of material and efficiently work their way to the top. In most manufacturing systems, both the material requirements planning and the product cost-accumulation processes require low-level codes.

Mainframe manufacturing systems usually calculate low-level codes during bill of material processing. Since low-level code calculation is tricky to program and often requires lots of memory, some microcomputer manufacturing systems have moved it to a separate program the user must remember to run after every change to a bill of material. *MRP-II*, however, does continuous low-level code maintenance as a normal part of bill of material maintenance, just as the mainframe systems do.

MRP-II limits bills of material to twenty levels. The quantity of a component part in stock to be used on an assembly may be as large as 9,999,999, or as small as 0.00001. These limits aren't really limiting. If they don't look adequate, you're probably structuring your bills of material incorrectly or using inappropriate units of measure.

Parts can be defined on the item master as either purchased or manufactured, and as bills of material are created, the program checks the purchased/manufactured code. Purchased parts are not allowed to have components and manufactured parts must have them. Although this edit scheme makes sense and will be helpful in constructing accurate, error-free bills of material, it makes the initial bill of material construction job difficult. One must start at the bottom of the bills and work up to the top, rather than build in pieces and later bring the pieces together into a complete bill of material.

There is no provision for "negative quantity per" in the bills of material. Although this precludes the use of modular bills, Twin Oaks promises that modular bill facilities will be available in the as-yet-unreleased master scheduling package.

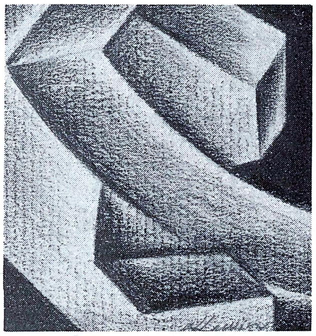
The *MRP-II* system's bill of material reporting program is excellent. It features both explosions and implosions, single-level and multilevel reports, both full file and single part reports, summarized reports, and even batched summarized reports. This set of reports is complete and will meet almost any company's needs.

Inventory Control Subsystem. *MRP-II* supports multiple storage locations for any stocked part on the item master; the permissible stocking locations must be defined in advance for each part. Although *MRP-II* could have been designed to build records as material is placed into a location, predefining the locations gives additional control over inventory accuracy and, therefore, over inventory investment.

MRP-II notably does not permit entry of a safety stock quantity.

Although good planning should eliminate the need for safety stocks, few manufacturers are able to do without them from the very beginning. A better approach is to plan for safety stocks until inventory records are demonstrated to be better than 95 percent accurate, and then to slowly reduce safety stocks to zero.

MRP-II features a basic set of inventory and costed inventory reports. This is a good, sound, basic inventory control system complete with on-line and interactive inventory updating and the necessary audit trails.



Pick List Subsystem. The pick list subsystem prints single-order and multiple-order pick lists. It has an optional availability check that warns when an item is out of stock but does not allocate (reserve) stock in advance of picking.

The program includes a group withdrawal transaction, which allows you, with a single input, to withdraw all material required to produce an order. Group withdrawal is a valid if risky technique. On the one hand, it spares you the trouble of manually entering individual withdrawal transactions for every item in a pick list. On the other hand, the assumption that all the items are present and have actually been pulled from stock may be faulty. If inventory records are inaccurate, group withdrawal will tend to make them worse.

Standard Cost Development Subsystem. *MRP-II*'s standard cost development subsystem is one of the stars of the show. It's more powerful and more complete than those provided by many mainframe systems.

MRP-II can accumulate standard costs from elemental costs through the bill of material. According to Twin Oaks, when its routing subsystem is released, the standard costing system will also perform accumulations through the operations to arrive at elemental labor costs. Operation setup costs will be included in labor cost based on a user-supplied standard lot size.

MRP-II maintains separate fields for material, labor, burden, and outside processing costs. It accumulates all four costs separately and supports all four fields for both elemental and total costs. It includes two complete sets of these eight costs called *current* and *standard*. Current cost is under the user's control. Standard cost can be modified only by copying the current cost into it. Under normal circumstances, a user would continually update the current cost fields as prices and labor costs change and would restandardize costs periodically according to the company's accounting rules.

A rollup program accumulates the costs. A rollover program transfers them from the current fields to the standard fields. *MRP-II* supports cost rollups for individual part numbers; unfortunately, it does not support rollover by part, making it impossible to correct a standard cost error without reestablishing every standard cost in the file.

One could wish for the ability to increase or decrease current elemental costs by a global percentage; a program to recalculate burden costs based on a percentage of labor, material, and outside processing costs would be useful.

The cost development subsystem prints very flexible costed bill reports, a costed part listing, and a costed inventory report. It also reports zero cost elements under a simple user selection control. The zero cost element report could be more intelligent; as it is, it simply reports all cost fields containing a zero.

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All in all, despite a few omissions, this is a first-class costing system for a small manufacturing business.

Purchasing Subsystem. The purchasing subsystem records and tracks progress on purchase orders. It permits multiple line items per order and multiple due dates for a line item. There is no vendor file, so it cannot print the purchase orders, but it does produce open-order reports by order number, item number, due date, and vendor.

Purchasing also handles the movement of material from the receiving dock through inspection into stock. Users who do not require incoming inspection can route parts around inspection. The system permits material rejections and handles returns to vendors, although not very elegantly; returns are recorded as negative receipts. Purchase orders can be automatically closed based on the quantity received.

The receipt of material can directly update an on-hand balance in the inventory control subsystem. Like the group withdrawal feature in the pick list subsystem, this one has pros and cons. The feature is optional.

It would be useful to have a material status code for distinguishing between material awaiting inspection, material being inspected, material rejected and awaiting disposition, material to be scrapped or returned to the vendor, and so on. The system also needs additional reports to locate material in receiving and in inspection because inventory control reports do not show material in these departments.

MRP-II's purchasing system is a good basic one. It will help buyers keep track of orders, help receiving anticipate incoming material, and help the production department plan based on incoming material and material in inventory.

Documentation. *MRP-II* in its current configuration, arrives with eight manuals and ten disks. Unfortunately, there are no instructions telling the user where to start, so one has to scan the entire set to find the installation instructions. As it turns out, each book covers a subsystem and the installation instructions are in the control file subsystem book.

Twin Oaks assumes users understand the PC and PC-DOS. The user must also understand manufacturing systems, because Twin Oaks offers no tutorials in the manuals—nor should it. The *MRP-II* manuals should have page numbers, tables of contents, and indexes, as well as a major tutorial; and more examples are needed. Updates to the manual are impossible to file properly because the user doesn't know where to put the new pages. However, once the user learns how they work, the manuals are a reasonably good reference.

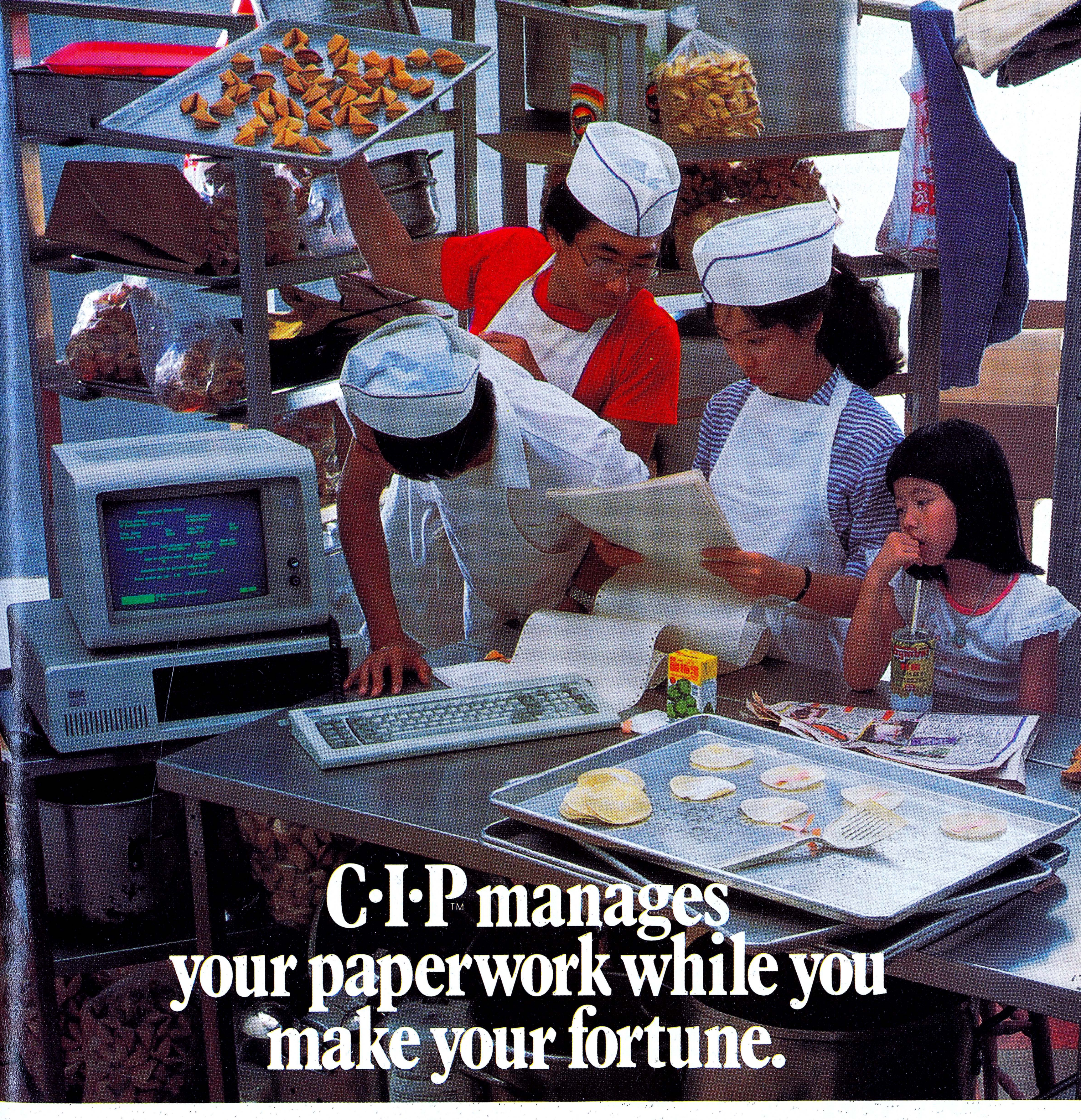
Summary

Typically, it takes more than a year to implement a manufacturing system to the point where everyone is comfortable with it, trusts the reports, and is willing to discontinue personal record-keeping. During this period of adjustment, of course, the business and the marketplace continue to change, causing the user's system needs to change. As a result, systems often end up being used in unanticipated ways. Features that look unimportant at first sometimes end up being crucial. So, the purchaser of a manufacturing system should be concerned not only with the system as it currently exists but also with the system developer's plans for the future.

Of course, predicting the future is risky, and no user should take any vendor's forecast at face value. There are always unforeseen problems and delays.

Most manufacturers find that they need to change their manufacturing systems as their business changes and as they develop more sophisticated controls. Because systems are large and complex and few suppliers are willing to release their source code, users often find themselves dependent on the system supplier for software maintenance. Buyers, therefore, should prefer large, established software suppliers to smaller, newer, and less stable companies.

Twin Oaks is neither large nor old. The company has, however, placed the *MRP-II* source code in escrow with a lawyer. Should the firm



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go out of business, the lawyer will make the source code available to all registered users, making it possible for a user to contract with a third party for ongoing maintenance and modifications. This escrow arrangement is important. Anyone interested in buying the *MRP-II* software should inquire about it.

Twin Oaks, however, appears to be a successful company with ambitious plans. Based on the quality of the work reviewed, *MRP-II* could be a good system choice for small manufacturing companies. A first-time system user will find it quite adequate, and Twin Oaks promises to issue new releases faster than most companies will be able to use them. These planned subsystems include work center maintenance, routings, shop orders, material requirements planning, engineering change control, and others. Several additional systems are scheduled for later release; these include master scheduling, shop floor control, and a more advanced purchasing subsystem.

Twin Oaks is working to improve the *MRP-II* documentation and to solve the problems in the system installation. Help screens will be added throughout the system. A user-oriented report generator is being developed, together with a subroutine that will let users write their own database access programs.

Twin Oaks plans to migrate *MRP-II* to the IBM System/34, System/36, and possibly the System/38. This migration is important to users who are concerned about outgrowing the capabilities of a PC. Twin Oaks also plans to repackage a stripped-down version of *MRP-II* and market it under the name *Churchmouse* for $1,395. *Churchmouse* should be available by the time you read this.

Although *MRP-II* is limited in documentation and function, it is an excellent foundation. If your company grows to $200 or $300 million per year, you will no doubt outgrow *MRP-II*. But, while you are small, it could be a good place to start.

The company offers a monthly seminar in Minneapolis for *MRP-II* users and prospective users. The price is $250 per day per student, which is in line with prices charged by other vendors of manufacturing systems. Twin Oaks offers free unlimited telephone support to its users and will make custom modifications on a quotation basis. A free forty-five-day trial copy of the software is available to any serious prospect. ▲

MRP-II, by Twin Oaks (2650 Colfax North, Minneapolis, MN 55411; 612-588-2685). Total system as released to date, $2,800; control and item master subsystems, $475; other modules range from $225 to $550 each; total system as planned, $8,425.

If you're interested in a manufacturing system for your business, it's important that you know how to organize and train both yourself and your employees. Proper education and planning can ensure that your use of a manufacturing system will make your factory more productive and provide better service to your customers.

Becoming a member of The American Production and Inventory Control Society (APICS) is a good way to start learning about manufacturing systems.

APICS (500 West Annandale Road, Falls Church, VA 22046; 703-237-8344) is a nonprofit professional organization founded in 1957 to educate both the membership and the general public in modern methods of controlling inventory and factory production. Today, APICS has more than two hundred active chapters and more than twenty thousand members.

APICS membership costs $50 per year. In return, the member receives the monthly journal and the opportunity to rub shoulders at monthly dinner meetings with both manufacturing system experts and novices. APICS sponsors local, regional, and national seminars and conventions and supports a highly successful national certification program. ▲

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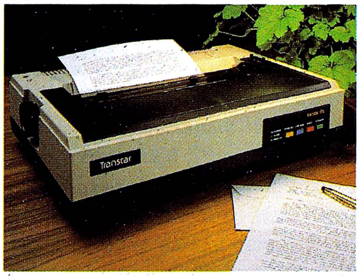

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Microcomputers have been cropping up all over Sinai Hospital, a 630-bed facility on the outskirts of Detroit. Nearly all are PCs, and their presence is due largely to the efforts of Edward M. Lichten, a physician who first describes himself as a hacker and then amends it to "plodder."

"I like to think of this hospital as a testing ground for microcomputers," Lichten says. It took some time to win this testing ground; Lichten's involvement with computers predates the hospital's involvement with them by more than a decade.

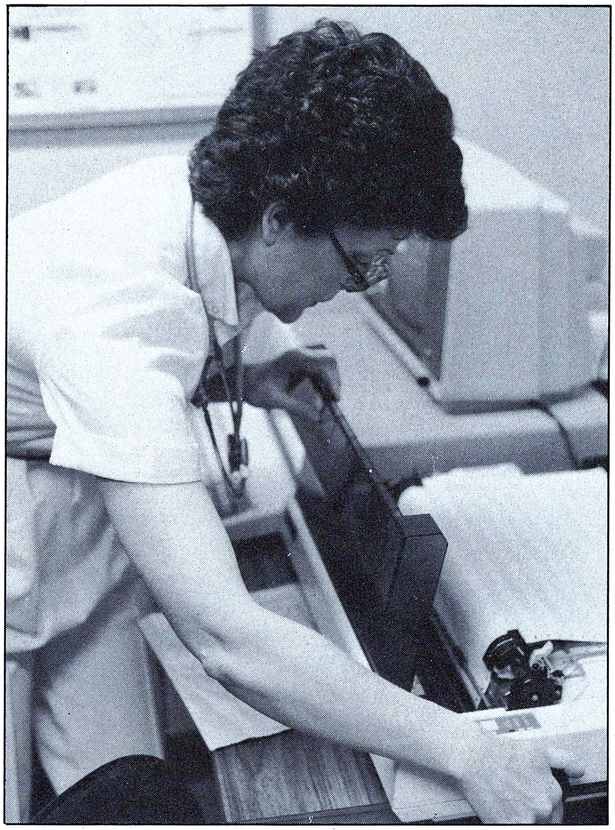
BY JAMES BRADBURY

A New Language. "In 1966 I was a pre-med with a part-time job stapling invoices at Firestone Tire and Rubber in Akron, Ohio." Sensing that his abilities were being wasted, Lichten went to management after a year and asked for something more challenging. "They said, 'Do you know anything about computers?' I told them 'No,' but that I had a good math background. So they said, 'Well, we're changing over from an old PDP-something to a new IBM 360/30, and we're going to start using a new language called Cobol.' So I went to work at minimum wage as a part-time Cobol programmer, and in 1967 I had a key to a five-million-dollar complex, filled with IBM mainframes."

Soon, Lichten was writing a billing system in Cobol for the company. "Of course, when I left, no one knew how I had programmed it. Good documentation is something you don't learn by teaching yourself to program."

For the rest of the sixties and most of the seventies, Lichten was understandably preoccupied with becoming a doctor. It wasn't until 1977, after he had gone into practice as an obstetrician/gynecologist, that computers reentered his life. This time, however, the computer wasn't a million-dollar mainframe.

"A doctor I worked with told me about the PET 1001, and I went out and bought one. It came with no manual, running Basic. The first night, I stayed up till four in the morning, learning to program in Basic."


Nurse Mary Porter examines the printout of a nursing note.

One of Those Days. Sinai Hospital handles about 3,500 deliveries a year. On this day, it looks like most of them will be C-sections. "Doesn't anybody do vaginal deliveries anymore?" Lichten asks no one in particular. The head nurse sighs. "Sometimes you just get one of those days," he says.

The rising frequency of Cesarean births is a serious concern to obstetricians. At this hospital, however, fetal monitoring by way of the microcomputer is helping doctors follow their patients' progress during labor and warn of pattern changes indicating possible abnormal fetal conditions.

Before microcomputers can do this job, though, they have to get admitted to the hospital. Lichten recalls how his Apple came to work at Sinai.

"I always had the idea that I could merge my profession and my hobby," he says. "Of course, some people think it ends up the other way. In 1979, I decided that the computer was fast enough to allow me to do some analog-to-digital interfacing."

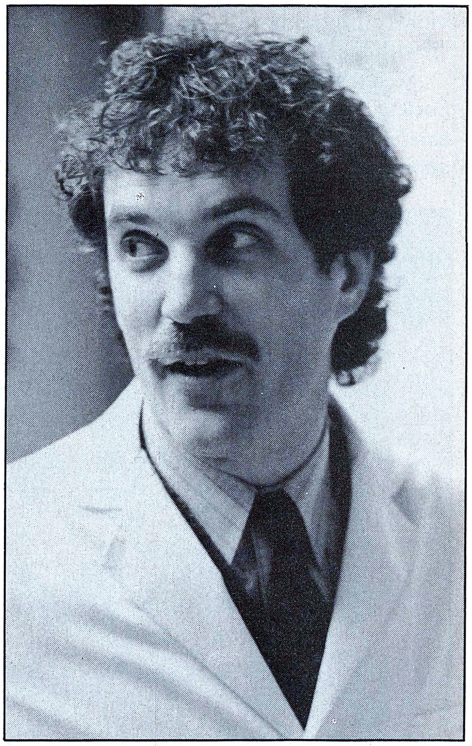
As usual, the first hurdle was funding. "I went to the hospital and said I wanted to use the computer to make some measurements on the heart parameters of the baby in utero. They looked at me like I was nuts. One of the doctors said, 'I've been working with computers for ten years (he had a room-sized DEC), and what you're talking about is impossible.' "

Naturally, Lichten felt otherwise, and he was able to finance $5,000 from the department funds to buy and outfit an Apple II.

The first step was obtaining help from someone who knew the Apple well. "One of my colleagues' sons, David Snider, had done machine language programming on the Apple, and he worked with me over the summer." (This same David Snider later made his own fortune writing the games *David's Midnight Magic* and *Serpentine*.)

"We showed that we could take the signals off the machines and display them on the Apple and stop them and measure them like an oscilloscope."

Although this proved the doubtful doctor wrong, Lichten wasn't satisfied. "I thought, wouldn't it be neat if we could get the computer to analyze the tracings once they had been done? David was away at college, but he had shown me two little programs with forty lines of machine code, and those were my tutorial. It took me two and a half years to get the patterns displayed the way I needed them. Then I decided to try to get the machine to do some evaluations. I didn't tell the hospital that's what I was going to do or they really would have thought I was crazy.


Dr. Edward M. Lichten is a self-confessed hacker.

"If you show a tracing to a doctor and ask him why he thinks the pattern is an early or a late, he may not be able to tell you. He'll just say it looks like it. But there are mathematical criteria for these phenomena. I put them into the machine, and it worked reasonably well. There's about an eighty-five-percent correlation between what I think, what the resident thinks, what the perinatologist thinks, and what the computer says."

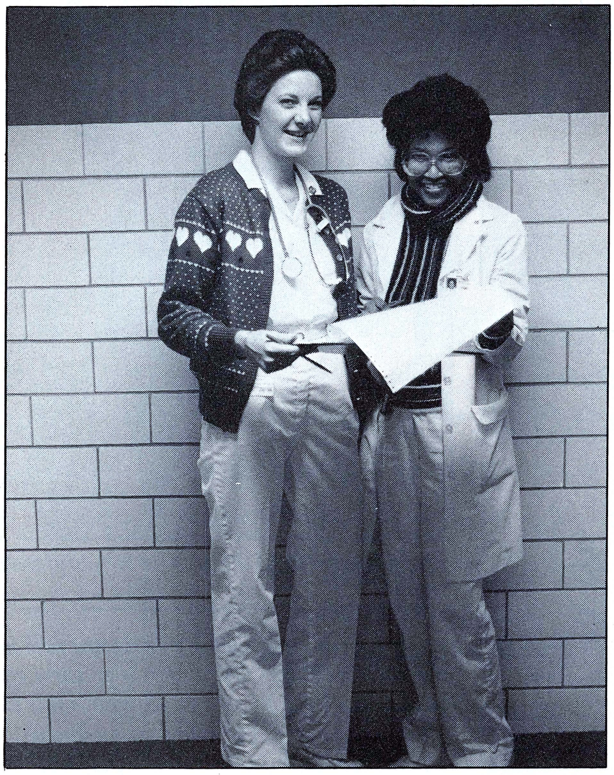
Getting micros into the hospital required more than writing a useful program for a micro and setting it up in the obstetrics ward. "In some ways we're fortunate that our hospital had not implemented a hospital information system," Lichten says. "The hospital decided in 1982 to support microcomputer applications that could improve patient care."

Lichten's proposed alternative? A network of micros, all linked to the mainframe and able to draw on its reserves of memory, but maintaining their own independent CPUs. The microcomputer that would make this possible? IBM's PC.

As it did in so many other settings, the PC played a big role in legitimizing the presence of microcomputers in the hospital. Although the Apple was fine for analog-to-digital applications, the PC offered real advantages for Lichten's other projects.

"The communications buffer is built in, the clock's built in, you've got upper and lowercase, the processor is a little faster, and the Basic is much more extensive. I thought it would be a more reliable machine for the floor. And we wanted a standard that could communicate more comfortably with the hospital's IBM and Hewlett-Packard mainframes."

While attending the annual meeting of the Society for Computer Applications in Medicine in late 1982, Lichten got the idea for an application he felt could usher the PC into the hospital. "A resident from another hospital in the city had put together a system on an Osborne to do case histories. Another doctor was using a portable Epson in a nursing station to allow nurses to take notes, print them out on calculator paper, and tape them to charts. I thought it would be nice to take those two functions and build them into a nursing unit."



Nurses Kathy Duff (left) and Marlene Taylor compare notes with a computer-generated nursing log.

Dr. Lichten was able to fund these two separate functions with support from the hospital's educational fund. The hospital physicians felt that legible and complete histories would be an interesting and practical application of microcomputers in medicine.

"Doctors take courses, you know, in illegible handwriting," he says. "It's part of the curriculum in medical school. And their histories, in addition to being illegible, are usually incomplete. All the doctors thought it was a great idea."

Lichten's program performed several functions. For the residents, it generated histories that were both legible and complete. For the nurses it did even more.

"When I brought the idea up, I got together the head of nursing, nursing administration, and the people from management engineering. We all sat down and said, 'What will be best for the nurses?' I took it up to the floor, and it was about sixty percent right. The nurses on the floor had things that were important to them that the head nurses didn't know about. So I changed the program to fit their needs."

The program's primary purpose is to help with the recording and sharing of clerical information so more time would be available for patient care. One area targeted was team reports.

"Every time there's a change of shift, the nurses transfer information that's been collected on the patients," Lichten explains. "This is a manual transcription process where the nurses sit around the table and discuss the problems of their patients. This is all written down and handed to the ward clerk, who then goes down and makes twenty copies of it. I thought--the name's not changing; with vital signs there will be only a small element that needs to be updated; and the treatments will change slowly. . .so why not get all that information in the computer and just update whatever needs updating?"

The program also keeps a log of nursing notes and patient acuities. Information about the latter helps nurses determine which patients are the sickest. In addition to more reliable reports, the program has provided significant time savings.

"The ward clerk saves about an hour a day," Dr. Lichten says, "which means that the computer ends up paying for itself in about eight months." That's hardly a bad return for a program in compiled Basic that took less than three months to get up and running. Lichten's beachhead was established.

"The idea behind the nursing station was to create a comfortable attitude in the hospital toward computers. Nurses are not afraid of the computer. They look at it as another piece of electronic equipment."

Parking Cars. The time had come to find other uses for PCs in the hospital. To be fully integrated into the hospital's information network, however, the PCs would have to interact with the mainframes. Recognizing the limits of his own hacker's expertise, Lichten looked for outside help—and found it in an unusual place.

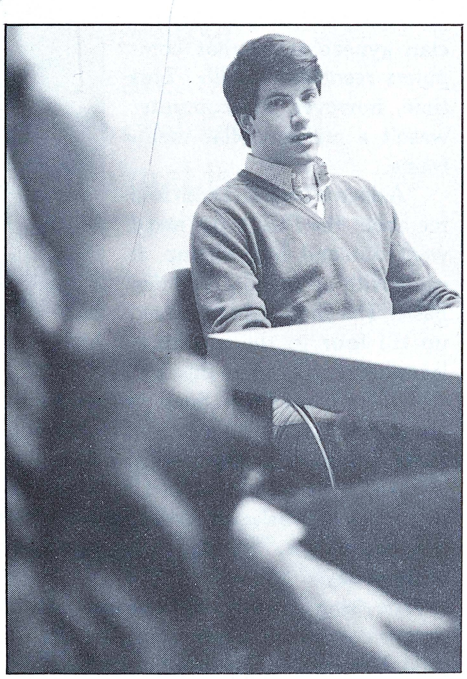
"I was parking cars at a party given by a doctor whose son I knew," recalls Larry Freed, a recent University of Michigan computer science graduate. "One of the doctors came out and said, 'I understand that one of you guys is into computers.' I told him I was, and he said that he could get me a summer job."

The doctor, of course, was Edward Lichten, and the job turned out to be a student fellowship in the cardiology department at Sinai. It marked both the beginning of Freed's association with Lichten and his introduction to the PC, which is used as a freestanding terminal for the cardiology department's mainframe system.

"Probably the biggest advantage of the PC is that it's the most common micro, and more people understand it," says Freed. "Since it's a standalone CPU, you don't have to compete with other people. If you hook it up to mainframes, you get the best of both worlds, because you can centralize the information and use the PC to draw it off once."

To avoid losing the advantages of the PC's independent CPU, Lichten and Freed developed software to interface micro with mainframe. The mainframe people had considered using 3270 interface boards in the PC.

"I told them that doctors at home will want to communicate with hospital computers," says Lichten. It makes more sense for the hospital to interface an asynch board to the mainframe."



Larry Freed went from parking cars to programming PCs.

Lichten and Freed, together with Tom Bauld, a biomedical engineer, are setting up several other PC projects that they hope will be models for other hospitals. One that's almost

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done is a system for keeping track of the requirements that different surgeons have for various operations.

"In the operating room, I use this type of suture and this type of instrument for this case. I want size seven-and-a-half gloves, and I use such and such a microsuture. Every doctor has a different request," Lichten explains.

Physicians' preferences are currently kept on file cards. The day before an operation the nurses send a request to central supply and a package is made up containing the correct supplies. Most of the time. If the doctor's preferences have changed, as they often do, or if a mistake is made, a nurse has to run back down to central supply and get the proper instruments.

Lichten's program will use an XT with three interactive files to automatically generate a list of necessary equipment based on the physician's name and the procedure being performed. "For sixteen rooms doing seventy to seventy-five operations a day, the hospital figures it will save almost one nurse per day."

The project after that will address one of the biggest problems facing the administration of any hospital: scheduling. "The average scheduling cost to a hospital with three thousand employees is probably one hundred thousand dollars a year," says Lichten. "And that's a conservative estimate. I figure I can do it a lot faster and a lot fairer for a lot less. I'll generate four alternative schedules and let the hospital pick the one they want."

Better Control. A long-range goal is to integrate some of these individual applications into a larger database that will give insights into how effectively the hospital is running. The nursing stations are a good example.

Lichten says there's a wealth of useful information in nursing notes. "Pull that information back and you'll have better control over how medical care is delivered and how patients are doing," he predicts.

Even farther down the road, Lichten would like to see the computer make contributions to medicine based on artificial intelligence. "I have a great interest in AI. My only question is if I have trouble figuring out how *I* think as a physician, then how can I teach a *machine* to think?"

As for expert systems (AI programs designed to do such things as diagnose diseases), database expert Freed points out a fundamental limitation: "They're too dependent on opinion. If you took the same data and went to ten doctors, you'd probably get eight different opinions. All an expert system would be is a collection of the opinions of one of those doctors. For most diagnoses, the computer would come out with that doctor's opinion, but there's no guarantee it would be right."

Lichten agrees. "A patient's symptoms set off different thinking in different doctors. The

Head nurse Shirley Wright holds the documentation for the nursing station program.

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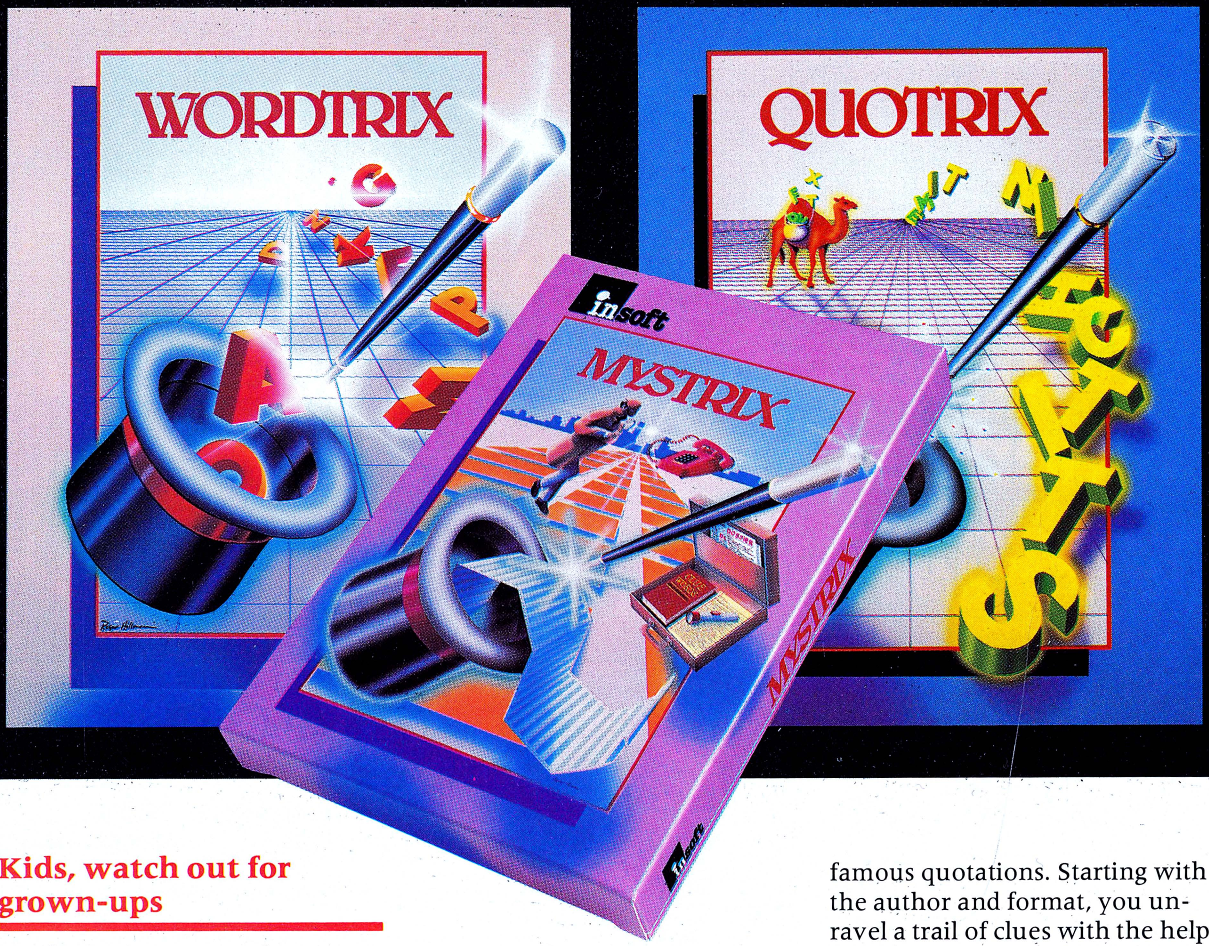

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point is not the number of tests a doctor runs, but how he interprets the information. If medicine keeps pushing for more and more diagnostic testing, physicians miss the tool they were given—the one between their ears. Medicine is an art, not a science. The computer is a science, no question about it, and it can support medicine. But to replace the art of medicine with computer science is something that I don't think will happen."

The battle to bring the micro into medicine is far from finished. "The slowest industry to change is medicine," says Lichten. "It's status quo. Whatever change we produce takes time."

To help share his ideas, Lichten formed a computer forum for physicians in Detroit as a place where "people could bring their software and get answers to questions." And, of course, there's the Society for Computer Applications in Medicine. "1983 was the first year that thirty or forty percent of the presentations were micro. In 1981, I gave one of only six microcomputer papers at this national meeting."

In medicine, the micro movement promises to be a grassroots campaign promoted by energetic hobbyists, such as Lichten. "People will bring the micro from home," he says. "The educational process I go through with all my friends is 'I have to get a computer for my kids and I don't know what I should do. Will you come over and set it up for me?' And the kids sit down while their parents stand there."

Just how extensive a role the PC will play in the hospital of the future may in the end be determined by the imaginations of those who use it. Lichten is fond of stressing that applications such as his nursing station are to a large extent developed by the people who use them.

"The ways a computer can be used in a hospital are unlimited," he says. "I've explored analog-to-digital. I've explored communications between nurses on floors. Maybe someday I'll get into artificial intelligence."

Meanwhile, a new mother holds her noisy baby up with unconcealed pride and delight. He is two days old. His first experience with a microcomputer came when he was still in the womb. He doesn't know it, but he is part of a generation for whom medical care will be better and more efficient, thanks to a quiet revolution in the practice of medicine.

"I don't know what we'd do without it," says one head nurse about the year-old PC in her ward. The prognosis is clear: Micros have a long hospital stay ahead of them. ▲

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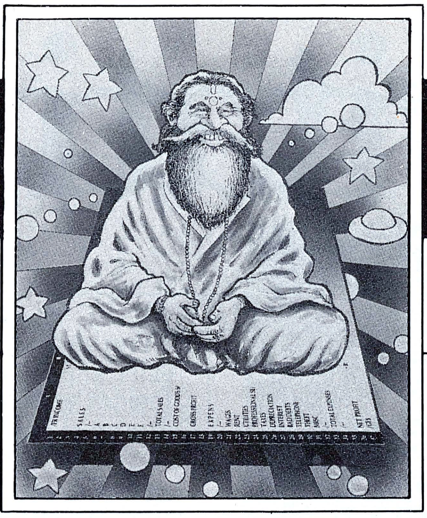


This month we feature a spreadsheet model to show the overall composition of your investment portfolio. Our model divides your investments into two groups—bonds and stocks. Figure 1 (page 77) shows the packed form of the portfolio model. Figure 2 shows the keystrokes you need in order to set up the model in *VisiCalc*. If you're working in *1-2-3*, note the following translations:

- /FR and /FL stand for format-right and format-left respectively. In this model they're used only to position labels, and you can ignore them since *1-2-3* conveniently allows label spillover.
- /F$ formats values to dollars-and-cents precision. Use either *1-2-3*'s currency format (/RFC2) or its two-decimal-place format (/RFF2), whichever you prefer.
- /- is a repeating label code, causing whatever character (or characters) that follows the hyphen to be repeated across the width of a cell. Substitute the backslash character for *VisiCalc's* /-.
- In cell G9, change (F9/F30)*100 to (F9/$F$30)*100. We'll want the second cell reference here to be absolute for the purposes of formula replication.
- In cell G24, change (F9/F30)*100 to (F9/$F$30)*100.

To demonstrate the use of this model, we'll analyze the hypothetical portfolio of a hypothetical forty-five-year-old office equipment sales manager. We'll start by entering his bond data into the spreadsheet; then we'll enter his stocks.

Let's say our sales manager holds the following four debt issues, listed at face value:

- $5,000 Gulf Oil 13.75-percent debentures due September 15, 2009, unit cost $99.50 per $100.
- $1,000 Tandy Corporation 10.00-percent debentures due December 31, 1991, unit cost $81.72 per $100.
- $1,100 McDonnell Douglas Company $4.75 convertible debentures due July 1, 1991. The conversion rate is $30.61 for each common share; the unit cost was $92.00 per $100.
- $500 Chase Manhattan Bank $4.875 convertible debentures due May 1, 1993. The conversion rate is $55.00 for each common share; unit cost was $88.25 for each $100.

Now let's turn our attention to the model and begin entering the investment information.

We'll divide the bonds into two groups: corporate and corporate convertible. First let's enter the "straight" corporate debentures—those that have no conversion privilege. Move your cursor to A8 so that you're over the label SECURITY. Now enter

CORPORATE

into this location, thereby replacing the general label by one that matches the type of securities we want to add.

Portfolio Analysis

Next we need to create more work space. Move to A9 and insert five rows.

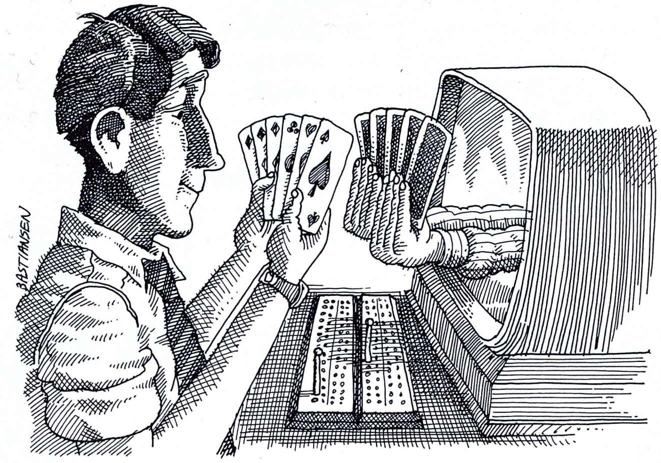
Now we have to replicate the dummy line that contains the formulas and formats our model needs. Since we want the first row of our model to be row 9 and since by inserting rows we've moved the dummy line to row 14, we need to replicate (copy) the formulas in A14 through J14 into the corresponding cells in row 9. *VisiCalc* users answer the relative/no-change queries in the following manner:

RRRRRNRR

Now we can input the data on the Gulf Oil debentures. Enter

at A9: **5000**
at B9: **GULF OIL 13.75%**
at C9: **99.95**
at E9: **85.75**
at H9: **13.75**
at J9: **16.00**

These values represent the par amount of the debenture, the descrip-



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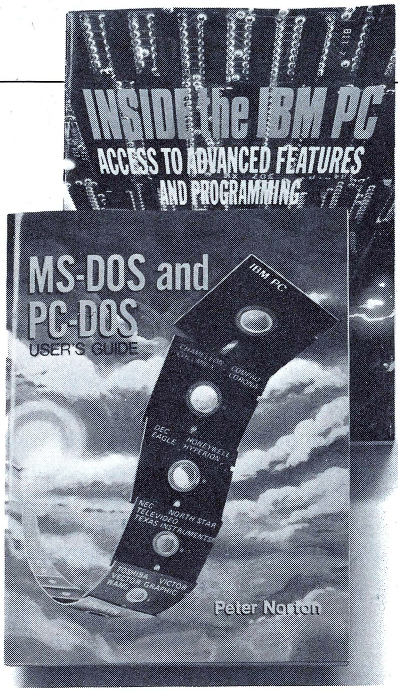
The authority, Peter Norton, takes a stand on the Microsoft Disk Operating system and has created a compendium of information on DOS unavailable elsewhere. Over sixty computers use MS-DOS or a related version, so this book will serve as a welcome reference for the PC at home or in the office.

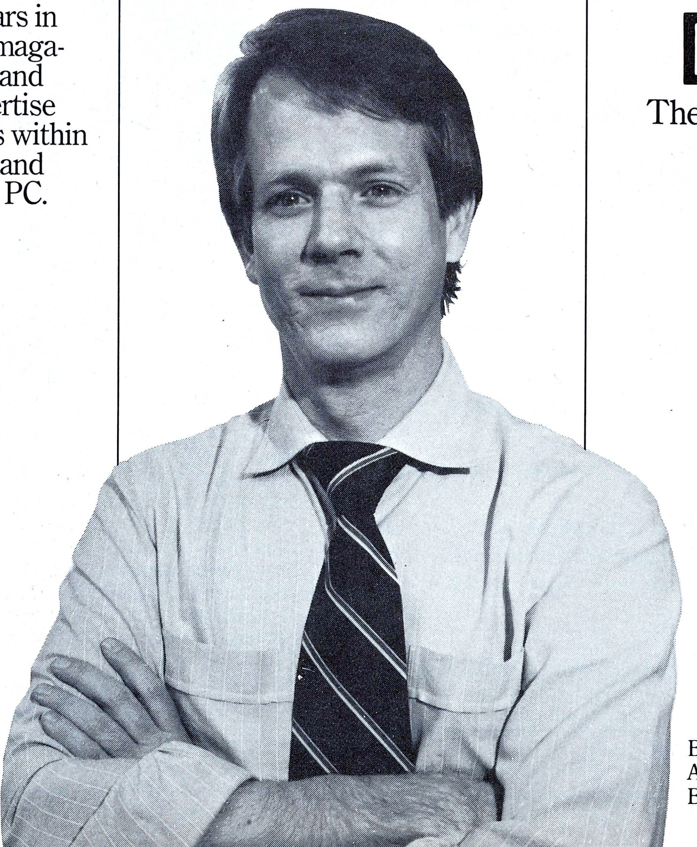
With handholding examples and explanations of MS-DOS, Peter Norton includes chapters on Fundamentals of DOS Commands, Getting the Most of DOS Editing Keys, What You Need to Know about Diskettes and File Formats Programming Languages, Batch Files, and Copy Protection. Norton gives expert advice on copy protection and software selection. For both the novice and the expert, he provides a glossary and a summary of commands for easy reference.

Peter Norton has earned his reputation as the authority on the IBM PC resulting from years in the field, articles in major magazines, lectures, interviews and consulting work. The expertise gleaned by Norton appears within the pages of his two books and benefits the reader and his PC.



"MS-DOS and PC-DOS: User's Guide"
Peter Norton 1983/250pp/paper/ISBN 0-89303-645-5/D6455-2/$15.95

"Inside the IBM PC"
Peter Norton 1983/320pp/paper/ISBN 0-89303-556-4/D5564-2/$19.95
Book/Diskette 1983/ISBN 0-89303-558-0-D5580-8/$79.95



The book that has become the final companion to the machine, "Inside the IBM PC: Access to Advanced Features and Programming" illuminates the inner workings of the machine while demonstrating how both beginning and advanced programmers can take advantage of the many features offered by the PC. Norton also explains how the ROM is allocated for BASIC and BIOS. He explores the RAM for functions like the monochrome and color monitor displays and shows how the assembler can be integrated into Pascal and BASIC to access more power from the IBM PC.

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```
                                        BOND  SECTION
                     ***************************************************
                                    UNIT    BOOK     MARKET  MARKET   % OF                ANNUAL
PAR VALUE        SECURITY           COST    VALUE    PRICE   VALUE    TOTAL    INTEREST   INCOME   YIELD
SECURITY
                                            0.00             0.00     ERROR               0.00
TOTAL            BONDS                      0.00             0.00     ERROR               0.00

                                        STOCK  SECTION
                     ***************************************************
NUMBER OF                           UNIT    BOOK     MARKET  MARKET   % OF                ANNUAL
SHARES           SECURITY           COST    VALUE    PRICE   VALUE    TOTAL    DIVIDEND   INCOME   YIELD
SECURITY
                                            0.00     0.00    0.00     ERROR    0.00       0.00     0.00
TOTAL            STOCKS                     0.00             0.00     ERROR               0.00


PORTFOLIO TOTALS                            0.00             0.00     ERROR               0.00
```

Figure 1.

tion, the purchase price, the current market price, the interest rate, and the yield. The current market price and yield of a security can be found in *Barron's* or the *Wall Street Journal*.

Our model calculates the book value, market value, and annual income for this security. The book value tells us what we paid for the debenture, while the market value is its worth today. The % OF TOTAL column reveals how much of our total holdings are represented by this security. The current value of the portfolio is used for the percent of total calculation. So far we've entered only the one debenture, and it represents 100 percent of our portfolio. This number will change as we add more securities.

To complete our description of the Gulf Oil debenture, we should include the due date. Let's put this on the line below—row 10. At B10, enter:

DUE 09/09

Now we can add the second corporate bond. To begin, we want to replicate the dummy line (still row 14) into row 12. We'll leave row 11 blank to make the spreadsheet a little more readable.

Put your cursor back on A14 and copy cells A14 through J14 into the corresponding positions in row 12. This is the same operation you did a few moments ago, only with a different target range; *VisiCalc* users, don't forget the no-change reference (the sequence, once again, is RRRRRNRR).

Now, go to row 12 and enter

1000
TANDY CORP 10.00%
81.72
72.25
10
14.00

in columns A, B, C, E, H, and J respectively. Add the expiry information at B13: DUE 12/91.

So much for corporate bonds. Notice that if you move your cursor down column A, you'll come to the TOTAL BOND line. At this point, that line shows that the total book value for these bonds is $5814.70 and the market value is $5010.00; combined, the two corporate bonds make up 100 percent of our portfolio and will contribute $787.50 in income.

Now let's move along to the convertible bonds.

First, we'll create some more operating room. With your cursor anywhere in row 14, enter the appropriate commands to insert ten new rows. This will put your dummy line into row 24.

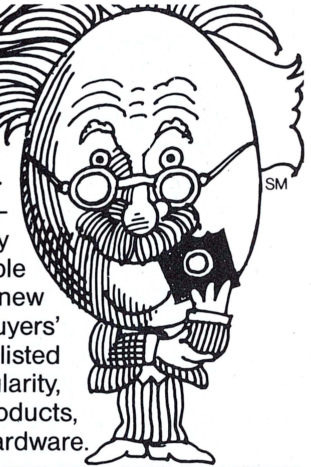
The heading for the next set of securities will go in cells A15 and B15. At those two locations, enter:

CORPORATE
CONVERTIBLE

On the following line, add the data for the McDonnell Douglas convertible debentures. First replicate the dummy line. This time, you're copying cells A24 through J24 into row 16, following the same relative/no-change pattern as before. Now add the data:

A16: **1100**
B16: **MCDONNELL DOUGLAS $4.75**
C16: **92.00**
E16: **96.00**
H16: **4.75**
J16: **@NA**

We don't show the yield for the corporate convertible debenture, be-



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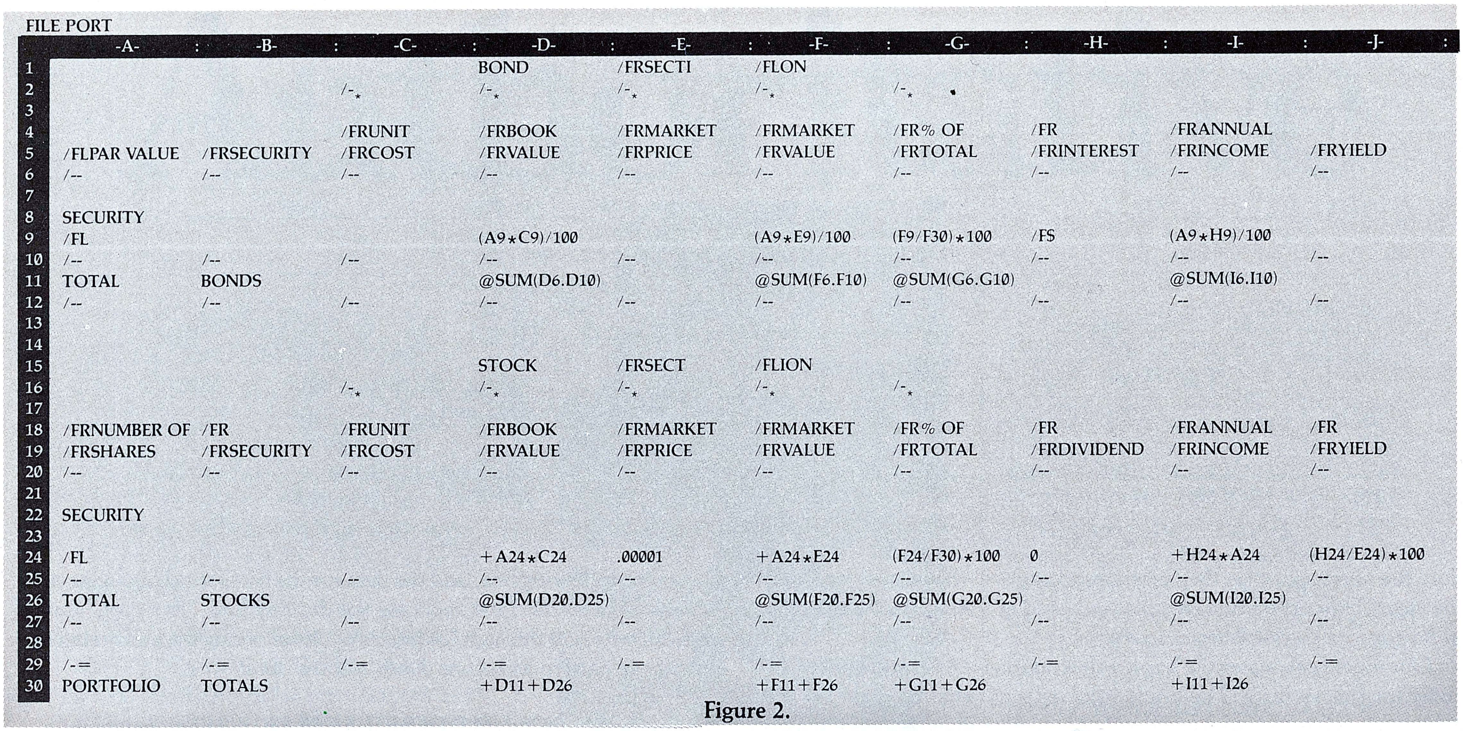

FILE PORT

	-A-	-B-	-C-	-D-	-E-	-F-	-G-	-H-	-I-	-J-
1				BOND	/FRSECTI	/FLON				
2			/-*	/-*	/-*	/-*	/-*			
3										
4			/FRUNIT	/FRBOOK	/FRMARKET	/FRMARKET	/FR% OF	/FR	/FRANNUAL	
5	/FLPAR VALUE	/FRSECURITY	/FRCOST	/FRVALUE	/FRPRICE	/FRVALUE	/FRTOTAL	/FRINTEREST	/FRINCOME	/FRYIELD
6	/--	/--	/--	/--	/--	/--	/--	/--	/--	/--
7										
8	SECURITY									
9	/FL			(A9*C9)/100		(A9*E9)/100	(F9/F30)*100	/FS	(A9*H9)/100	
10	/--	/--	/--	/--	/--	/--	/--	/--	/--	/--
11	TOTAL	BONDS		@SUM(D6.D10)		@SUM(F6.F10)	@SUM(G6.G10)		@SUM(I6.I10)	
12	/--	/--	/--	/--	/--	/--	/--	/--	/--	/--
13										
14										
15				STOCK	/FRSECT	/FLION				
16			/-*	/-*	/-*	/-*	/-*			
17										
18	/FRNUMBER OF	/FR	/FRUNIT	/FRBOOK	/FRMARKET	/FRMARKET	/FR% OF	/FR	/FRANNUAL	/FR
19	/FRSHARES	/FRSECURITY	/FRCOST	/FRVALUE	/FRPRICE	/FRVALUE	/FRTOTAL	/FRDIVIDEND	/FRINCOME	/FRYIELD
20	/--	/--	/--	/--	/--	/--	/--	/--	/--	/--
21										
22	SECURITY									
23										
24	/FL			+A24*C24	.00001	+A24*E24	(F24/F30)*100	0	+H24*A24	(H24/E24)*100
25	/--	/--	/--	/--	/--	/--	/--	/--	/--	/--
26	TOTAL	STOCKS		@SUM(D20.D25)		@SUM(F20.F25)	@SUM(G20.G25)		@SUM(I20.I25)	
27	/--	/--	/--	/--	/--	/--	/--	/--	/--	/--
28										
29	/-=	/-=	/-=	/-=	/-=	/-=	/-=	/-=	/-=	/-=
30	PORTFOLIO	TOTALS		+D11+D26		+F11+F26	+G11+G26		+I11+I26	

Figure 2.

cause of the unknown effects of the underlying common stock.

To complete the background information, we need to add the redemption date as well as the conversion features. At B17 and B18, enter:

DUE 07/91
CONV @$30.61/SHARE

We'll put a line between the securities and replicate our dummy line (A24 through J24) into line 20—in the same fashion as before. With that done, you can put your cursor on A20 and enter the final convertible security:

A20: **500**
B20: **CHASE MANHATTAN BANK $4.875**
C20: **88.25**
E20: **102.50**
H20: **4.875**
J20: **@NA**
B21: **05/93**
B22: **CONV. @$55.00/SHARE**

All right, now you're finished with the bond section of the spreadsheet. By examining the total line, you can see that the bond section has a total book value of $7,267.95 and a market value of $6,578.50. Since we haven't added any stocks yet, the bonds comprise 100 percent of the portfolio. The expected annual income from these investments is $864.13.

Those of you who hold mortgages as part of your portfolio can record them in the bond section as well. Simply record the face value of the mortgage in the par value column, then enter the cost and market value as 100. The effective interest rate goes into the interest column as well as the yield column, and the annual income is automatically calculated.

Now we can turn our attention to the stock section of this portfolio. The same principles apply here. Simply insert rows to make room for securities, and then enter the appropriate information.

Let's look at the stocks that our sales manager has bought over the last few years. The following list describes his entire stock holdings and the average costs per share:

- 100 shares of Colgate-Palmolive $3.50 cumulative preferred shares at $34.50 per share.
- 100 shares of General Dynamics $4.25 cumulative convertible preferred shares at $70.25 per share.
- 300 shares of General Dynamics common at $12.50 per share.
- 100 shares of Northrop Corporation at $40.25 per share.
- 200 shares of Hewlett-Packard Company at $24.25 per share.
- 100 shares of Texas Instruments at $110.50 per share.
- 300 shares of CBS Incorporated at $61.00 per share.
- 100 shares of Warner Communications at $15.25 per share.
- 200 shares of Tandy Corporation at $37.60 per share.
- 100 shares of Sears at $28.10 per share.

To make the stock portion of the model a little more meaningful, we'll divide the stocks into two major sections: preferred and common. The preferred stocks will be further divided into preferred and preferred convertible. And we'll display the common stocks under industry headings.

To make our work a little easier, we'll anchor the column headings of the stock; this will let us refer to the headings as we enter data. Scroll down the screen so that the NUMBER OF label in column A is at the top of the screen. Move your cursor to A34, which should be on the second line of your screen. Now enter /TH (*VisiCalc*) or /WTH (*1-2-3*). This will freeze the headings into place.

With your cursor in row 39, enter eight new lines; after you do, the dummy line that we'll be replicating for the stock portion of the model will be inhabiting row 47. Change the label at A37 from SECURITY to PREFERRED.

Now replicate (copy) the dummy row into row 38. For *VisiCalc* users the relative/no-change sequence is: RRRRRNRRRR. This will keep the second cell reference in the percent-of-total formula absolute.

Now enter the Colgate data:

A38: **100**
B38: **COLGATE-PALMOLIVE**
C38: **34.50**
E38: **29.50**
H38: **3.50**
B39: **$3.50 CUMULATIVE**

Notice that the stock yield is calculated automatically. In the bond section of our model we had to enter this information manually, because the calculation of bond yield to maturity depends on too many factors for it to be automated by the model. The yield of a stock, however, is easy to calculate; it's the dividend divided by the current price of the stock.

If you're getting tired of waiting for your spreadsheet program to

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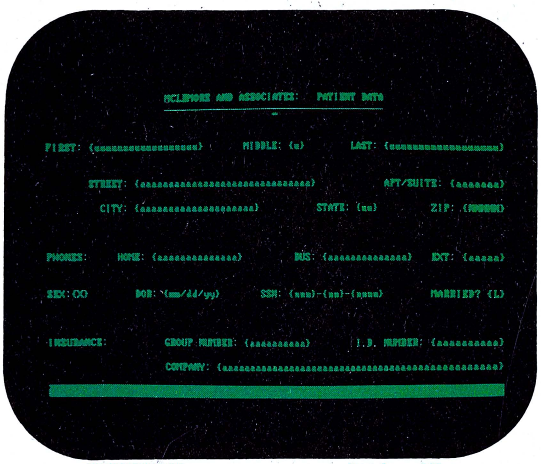
MCLEMORE AND ASSOCIATES: PATIENT DATA
FIRST:
MIDDLE: (u)
LAST:
STREET:
APT/SUITE:
CITY:
STATE: (uu)
ZIP:
PHONES:
HOME:
BUS:
EXT:
SEX: (X)
DOB: (mm/dd/yy)
SSN: (nnn)-(nn)-(nnnn)
MARRIED? (L)
INSURANCE:
GROUP NUMBER:
I.D. NUMBER:
COMPANY:

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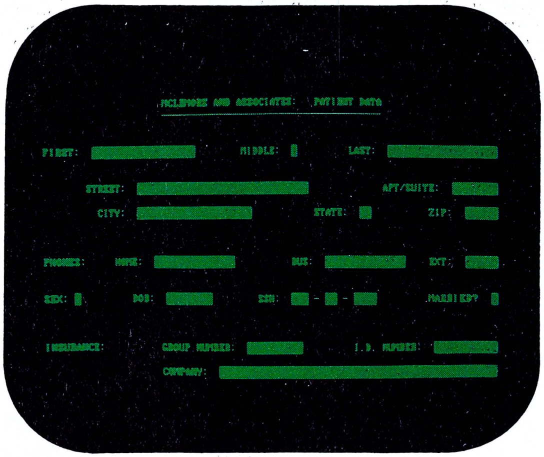
C. The resulting code may be incorporated in your systems to provide full-screen data input, review and storage features.


MCLEMORE AND ASSOCIATES: PATIENT DATA
FIRST:
MIDDLE:
LAST:
STREET:
APT/SUITE:
CITY:
STATE:
ZIP:
PHONES:
HOME:
BUS:
EXT:
SEX:
DOB:
SSN:
MARRIED?
INSURANCE:
GROUP NUMBER:
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COMPANY:

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recalculate after each new data entry, you may at this point wish to turn off automatic recalculation. /GRM will do the job in *VisiCalc*; in *1-2-3*, type /WGRM.

Now, before we enter the General Dynamics convertible preferred, we need to insert the appropriate heading. At A41 and A42, enter:

PREFERRED
CONVERTIBLE

Once again, replicate the dummy line, this time into row 42. Then enter the stock data:

A42: **100**
B42: **GENERAL DYNAMICS**
C42: **70.25**
E42: **89.50**
H42: **4.25**
B43: **$4.25 cum conv @ 2.27 COMMON/PREF SHARE**

Each preferred share of this security can be converted into 2.27 common shares at the owner's request.

This completes the preferred shares. We still need to enter the common stock data.

Insert six rows between row 44 and row 45; then, in A45 and B45, enter the label COMMON STOCKS. Now you're ready to input the first industry heading:

A46: **AEROSPACE**

One more time, replicate the dummy row. If everything has gone according to plan, the dummy line should be camping out in row 53 and you'll need to copy it into row 47. *VisiCalc* people, use the same reference pattern as before.

The data for the first common stock should go in as follows:

A47: **300**
B47: **GENERAL DYNAMICS**
C47: **12.50**
E47: **24.10**
H47: **.72**

At this point, you should be able to add the other securities in our sales manager's portfolio by following figure 3. Take the time to fill in the remaining common stocks and check that your answers agree with the ones shown in the figure. If you turned off automatic recalculation, be sure you do a manual recalc when you've finished entering the data; otherwise you can be sure your results will not agree with the figure's.

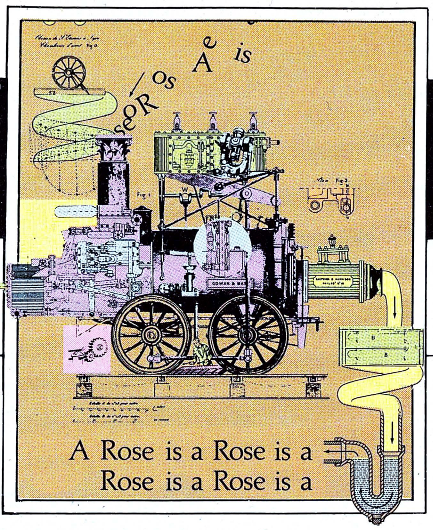
This model is designed to give you an overview of how your portfolio is composed. By dividing your securities into industry groups, you can see how diversified your holdings are. You can also model the impact that a stock purchase might have on the diversification of your portfolio. To do this, you simply enter the stocks and their prices into your portfolio and your spreadsheet program will tell you how the proposed purchase will affect your investment blend. ▲

```
                                                  BOND  SECTION
                              *************************************************
                                      UNIT      BOOK    MARKET    MARKET      % OF              ANNUAL
PAR VALUE         SECURITY            COST     VALUE     PRICE     VALUE     TOTAL  INTEREST    INCOME     YIELD
-------------------------------------------------------------------------------------------------------------
CORPORATE
5000              GULF OIL 1         99.95   4997.50     85.75   4287.50      5.82     13.75    687.50     16.00
                  DUE 09/09
1000              TANDY CORP         81.72    817.20     72.25    722.50      0.98     10.00    100.00     14.00
                  DUE 12/91
CORPORATE         CONVERTIBL
1100              MCDONNELL          92.00   1012.00     96.00   1056.00      1.43      4.75     52.25        NA
                  DUE 07/91
                  CONV @$30
500               CHASE MANH         88.25    441.25    102.50    512.50      0.70      4.88     24.38        NA
                  DUE 05/93
                  CONV @$55
                                                0.00                0.00      0.00                0.00
-------------------------------------------------------------------------------------------------------------
TOTAL             BONDS                      7267.95             6578.50      8.93              864.13
-------------------------------------------------------------------------------------------------------------

                                                  STOCK SECTION
                               ***********************************************
NUMBER OF                             UNIT      BOOK    MARKET    MARKET      % OF              ANNUAL
SHARES            SECURITY            COST     VALUE     PRICE     VALUE     TOTAL  INTEREST  INTEREST     YIELD
-------------------------------------------------------------------------------------------------------------
PREFERRED
100               COLGATE-PA         34.50   3450.00     29.50   2950.00      4.00      3.50    350.00     11.86
                  $3.50 CUMU
PREFERRED         CONVERTIBL
100               GENERAL DY         70.25   7025.00     89.50   8950.00     12.15      4.25    425.00      4.75
                  $4.25 CUM
COMMON            STOCKS
AEROSPACE
300               GENERAL DY         12.50   3750.00     24.10   7230.00      9.82      0.72    216.00      2.99
100               NORTHROP C         40.25   4025.00     45.25   4525.00      6.14      1.80    180.00      3.98
DATAPROCES
200               HEWLETT-PA         24.25   4850.00     40.75   8150.00     11.06      0.24     48.00      0.59
100               TEXAS INST        110.50  11050.00     79.75   7975.00     10.83      2.00    200.00      2.51
ENTERTAINM
300               CBS                61.00  18300.00     44.00  13200.00     17.92      2.80    840.00      6.36
100               WARNER COM         15.25   1525.00     58.50   5850.00      7.94      1.00    100.00      1.71
MERCHANDIS
200               TANDY CORP         37.60   7520.00     33.00   6600.00      8.96      0.00      0.00      0.00
100               SEARS              28.10   2810.00     16.50   1650.00      2.24      0.00      0.00      0.00
                                      0.00      0.00      0.00      0.00      0.00      0.00      0.00     ERROR
-------------------------------------------------------------------------------------------------------------
TOTAL             STOCKS                    64305.00            67080.00     91.07             2359.00
=============================================================================================================
PORTFOLIO TOTALS                  71572.95            73658.50    100.00             3223.13
```

Figure 3

THE PROCESSED WORD


seROs/Os A e is
A Rose is a Rose is a
Rose is a Rose is a

by Terry Tinsley Datz and F. Lloyd Datz

Punctuation + Style, StarIndex, and Updates

P*UNCTUATION + STYLE.* No one will deny that word processors can help you write more efficiently. But there's a big difference between writing efficiently and writing well. And word processors, being true diplomats, draw the line at passing judgment on the quality of our writing. After all, can you imagine *WordStar* giving you an error message like:

***ERROR E99: PLEASE INSERT A WRITER AT THE KEYBOARD ***

That's where electronic editors such as Oasis Systems's *Punctuation + Style* come in. Besides picking up capitalization and punctuation errors, *P + S* reviews your sentences for such writing flaws as passive voice and awkward or overworked phrases. Its criticism is constructive, however. Instead of leaving you dangling, *Punctuation + Style* comes up with suggestions for improvement.

Overall Design. As its name implies, *Punctuation + Style* is two programs in one—Cleanup (alias Punctuation) and Phrase (alias Style). Cleanup deals with the purely mechanical: misplaced or omitted periods, doubled words, capitalization errors. Phrase, on the other hand, concentrates on the more nebulous subject of writing style, relying on its own dictionary of commonly misused words and phrases.

Phrase and Cleanup both come with default settings for *WordStar* files, which prevent them from tripping over dot commands, soft hyphens, and other *WordStar* peculiarities. The program disk also includes optional settings for *PeachText*, *SpellBinder*, and *Perfect Writer*. You can customize the disk for other word processors, although you may need help if you're not familiar with the ins and outs of your program.

Cleanup

What Cleanup Does. Cleanup is based on a set of standard composition rules. One rule, for example, dictates that the first word of each sentence be capitalized. Therefore, every time the program comes to a period, question mark, or exclamation point, it checks to make sure that the next word is capitalized. It does make exceptions for words that follow abbreviations, at least those abbreviations it recognizes.

Using similar rules, Cleanup finds the following errors:

Capitalization errors. Besides checking the first word of each sentence for capitalization, Cleanup looks within each sentence for other errors. It expects all words to fall into one of three categories: all lowercase (for example, computer), all uppercase (IBM), or initial cap (Texas). With several exceptions, which we'll get to shortly, it assumes that any other mixes of case are incorrect. For example, it picks up typos such as "THe".

Now for the exceptions. For one, Cleanup is smart enough to recognize legitimate mixed-case words such as acronyms used as possessives (IBM's) or plurals (PTAs). It also stores a list of words with unconventional capitalization (JoAnn, McMurphy, and *WordStar*, to name a few). If you frequently use other mixed-case words, (*VisiCalc*, for example), you can add them to Cleanup's list of exceptions.

Punctuation errors. Cleanup detects six different punctuation errors involving periods, exclamation points, question marks, commas, ellipses, semicolons, and hyphens. These involve punctuation in an unexpected place, missing end-of-sentence punctuation, punctuation that belongs inside quotes, too much punctuation, punctuation with illegal spaces on either side, and incorrectly spaced ellipsis points.

Unmatched punctuation and embedded commands. Some kinds of punctuation marks (quotation marks, parentheses, and brackets, for example) almost always occur in pairs. Recognizing the fact that some people tend to forget the closing member of such pairs, Cleanup makes sure you finish what you start.

Although an unpaired quotation mark may be embarrassing, an unpaired *WordStar* boldfacing command can be downright infuriating. Just as it searches for unbalanced punctuation marks, Cleanup also makes certain that each toggle command has a partner. Should you forget to type the second ∧PB at the end of your document's title, for example, you get the polite message *Unbalanced toggle characters.*

Numeric errors. Cleanup is also meticulous about how you format numbers. It assumes that there should be three digits after commas, at least one digit preceding decimal points, and no commas to the right of decimal points.

Miscellaneous errors. Cleanup finds a few other odds and ends. Especially handy is its ability to ferret out doubled words, the waste products of word processing that always seem to escape the most careful proofreading. On the not-so-useful side, Cleanup flags abbreviations with embedded periods (such as Ph.D.) if they're not on its list of standard abbreviations.

It also checks that you put two spaces between sentences and one space after other punctuation such as commas and semicolons. Dashes, which Cleanup recognizes as two consecutive hyphens, are flagged if they're preceded or followed by either a space or punctuation. For *WordStar* files, Cleanup can tell the difference between spaces you insert and spaces the program adds to justify the margins.

How Cleanup Works. Cleanup doesn't begin with a main menu; to get started, you type *cleanup* followed by the name of the file you want to check. As Cleanup proofreads your document, it stops at each error and displays the line of text containing the mistake, with a caret pointing to the error's exact location. Below the line of text a message describes the error—for example, in the case of a doubled word, *"This word is repeated."*

A menu at the bottom of the screen gives you three choices: You can mark the error, ignore the error, or quit the program. The ignore option allows you to do a quick bypass when Cleanup marks something you think is okay.

If you agree with Cleanup about the error, you select the mark option. The program inserts an @ (or another symbol if you choose) so later you can use your word processor's

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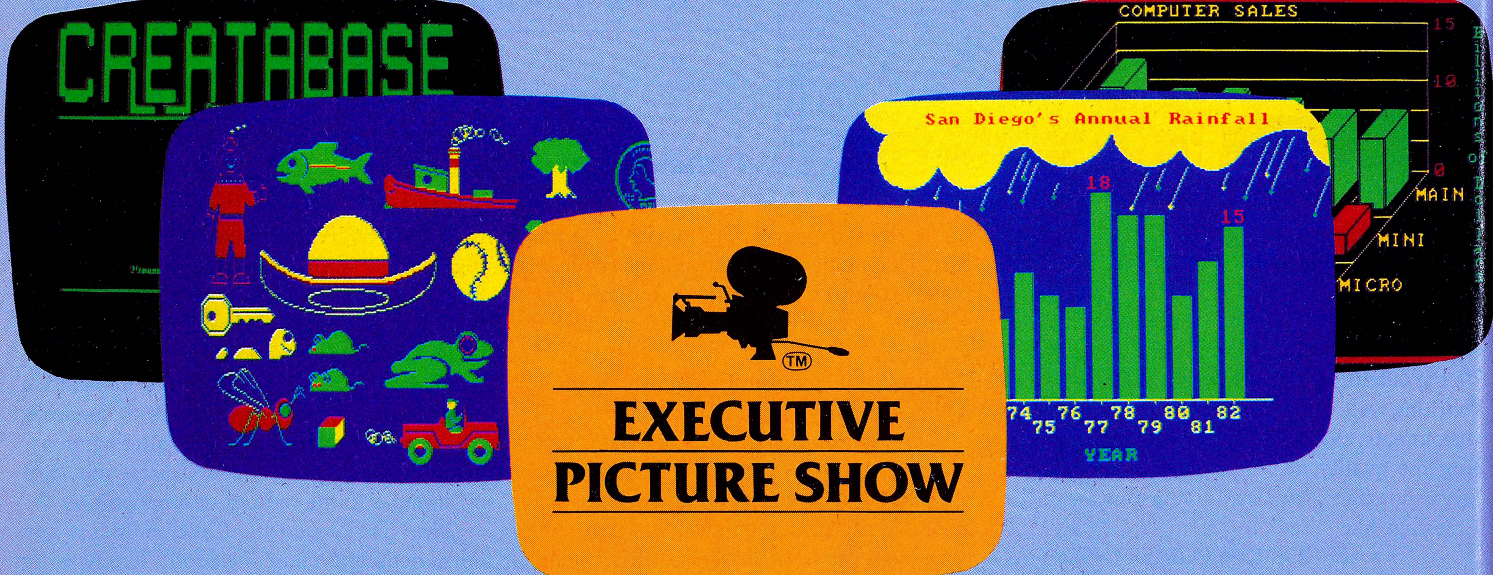

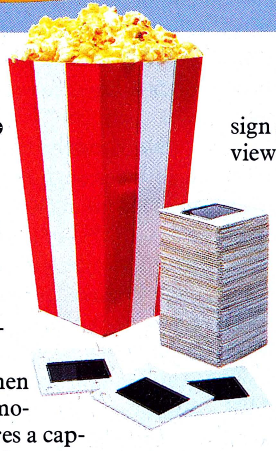

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2 disk drives or hard disk
IBM PC or IBM XT

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search function to find the mistake and correct it. In addition to marking the mistake, Cleanup inserts a short message at the end of the paragraph, numbered to correspond to the appropriate error. For example, a sentence with a couple of mistakes would look like this in your file:

```
Four score and and@1 seven years ago,
our forefathers brought forth upon this
continent a new nation ,@2 conceived
in liberty, and dedicated to. . .
..@1 This word is repeated.
..@2 Isolated punctuation.
```

After you correct the mistakes, you have to remember to delete the @s or they will print as part of your file. (Fortunately, in *WordStar*, the error messages won't be printed, since Cleanup inserts them as *WordStar* comment lines.)

Cleanup (and Phrase) keeps your original file intact by changing its extension to .bak and making a working copy for itself. This means you can still get at your original should you need it.

Cleanup allows you to change the defaults that dictate how it operates. After you give the name of the file you want checked, you type $ followed by the letter of the option you're changing. For example, by typing *$M#*, you can change the Cleanup's error-flagging symbol from @ to #. Another option allows you to switch to *quiet mode*, in which Cleanup flags all your file's errors without showing them individually on-screen. Another option, one that's handy for short files and for files in which you don't expect many errors, lets you suppress the individual error descriptions that Cleanup would otherwise insert into your text file.

Although Cleanup does a good job of ignoring *WordStar* dot commands, it does have one *WordStar* idiosyncrasy. If you mark an error in the paragraph preceding a header, that error's message sometimes will end up being printed as part of the header.

Cleanup can't be expected to detect every punctuation error in your manuscript. It can't, for example, tell where you need to insert commas to improve readability. Doing that would require the program to know the *meaning* of your sentences, something beyond the ability of any computer program. Besides, punctuation for such purposes is often a matter more of taste than of law. Other complicating factors (proper nouns, for instance) make it impossible for the program to check every word in every sentence for correct capitalization.

Phrase

What Phrase Does. Phrase is based on a series of programs called *The Writer's Workbench*, developed by Bell Telephone Laboratories for use on mainframes. If Phrase finds any one of seven hundred expressions from its phrase dictionary in your file, it brings the expression to your attention and offers suggestions for improvement.

Phrase divides its dictionary, called Writing Roadblocks (not to be confused with writer's block), into eight categories:

- awkward phrases—such as *as a consequence of* (substitute *because of*);
- cliches—such as *enclosed herein* (just use *enclosed*);
- erroneous phrases—such as *reoccur* (use *recur*);
- folksy phrases—such as *kind of* (use *somewhat*);
- muddy phrases—such as *quite* and *rather* (don't use);
- pompous phrases—such as *elucidate* (substitute *explain*);
- redundant phrases—such as *alternative choices* (just say *choices*);
- wordy phrases—such as *as of this date* (substitute *today*).

You can also create your own dictionary of phrases or edit the existing list by adding or deleting entries.

Phrase also checks your writing for lapses into passive voice. Most style manuals recommend using active voice when possible because it's clearer and more direct.

How Phrase Works. Just as with Cleanup, you have to get Phrase up and running without benefit of a menu. You type *phrase* followed by the name of the file you want checked plus the letters of any default options you wish to change. You can also choose the quiet mode and bypass reviewing each flagged phrase on-screen. Another option is to have suggestions inserted in your file either at the end of each sentence or at the end of each paragraph.

Each time the program finds a sentence containing a phrase or phrases from its dictionary, it shows you that sentence with the questionable items enclosed in brackets and offers its suggestions for improvement. A typical flagged sentence would look like this on-screen:

```
REASONABLY : ⟨AVOID⟩
REPRESENTATIVE OF :
⟨REPRESENT⟩
ENCOUNTER : ⟨FIND⟩

The spreadsheet templates are
[reasonably] complex and
[representative of] what you might
[encounter] in a business situation.

M⟩ark I⟩gnore P⟩rint or S⟩uppress
sentence?
```

If you took Phrase's advice, you would select M to mark the sentence so you could later return to your word processor and rework the sentence to read:

> **The spreadsheet templates are complex and represent what you might find in a business situation.**

Besides marking the sentence, you have three other options: ignore the flag, print the sentence along with Phrase's suggestions for improvement, or suppress the sentence so it won't be flagged if it appears again in the same file.

In searching for passive voice, Phrase uses a dictionary containing forms of the verb *to be* and a list of prepositions (prepositions frequently appear in passive-voice constructions). Unfortunately this technique is inadequate. Phrase will object to many constructions that are not passive at all. For instance, because it contains a form of the verb *to be* along with several prepositions, Phrase will make the mistake of flagging the following sentence:

> **The instructions [at] the bottom [of] the screen [are] concise.**

It's up to you to figure out which constructions are really passive and which are not. Unfortunately, sifting through all the flagged sentences in a file takes time (you could easily have as many as seventy-five in a ten-page document). Generally speaking, you shouldn't take Phrase's advice too literally. In some situations, the phrase it flags may be perfectly legitimate. In others, although you may agree that your sentence needs rewriting, you'll do better to ignore the program's suggestions and rewrite the sentence yourself.

Documentation and Support. *P + S*'s ninety-page manual is as readable as they come. The section describing Phrase contains specific examples of ways to improve your writing; this section includes paradigms of all eight types of offending phrases along with suggested replacements. Writing samples, shown both before and after the problem phrases have been replaced, demonstrate how much difference changing just a few words can make.

Although the manual's information is good, its organization is not. The commands you need to use the program are scattered haphazardly throughout the manual; both a quick-reference command card and an index would be helpful.

Ease of Learning and Use. *P + S* is easy to use once you've learned the handful of commands that run it. Since there's no opening menu, however, you do have to remember these commands—or else dig through the manual every time you use the program.

Audience. Will *Punctuation + Style* help you write the Great American Novel? No. It will, however, help you find writing flaws that you might otherwise miss. And whether you're a student writing a term paper or a manager turning out a report, Phrase can help you get your ideas across in a clear and simple style—or at least get you headed in that direction. In fact, if you use it often, you'll learn to spot problems before P + S has a chance to squeal on you.

System Requirements. P + S requires 64K and two disk drives (or a single drive and a hard disk). It isn't copy-protected.

STARINDEX.

Let's face it. In the computer age, you shouldn't have to use three-by-five cards for indexing. And if you insert material into a section-numbered document, you shouldn't have to renumber the rest of the document yourself. Unfortunately, with most word processors you're still stuck doing those chores by hand.

Well, *WordStar* users can throw out their index cards, because MicroPro's *StarIndex* has come to the rescue. *StarIndex* automatically creates indexes, numbers section headings, and generates tables of contents, all of which it formats to your specifications.

Overall Design. *StarIndex* works on *WordStar* files only. Using *WordStar*, you insert embedded and dot commands in your manuscript to tell *StarIndex* what words you want indexed and what headings you want numbered or included in your table of contents. Then, after saving your file, you run *StarIndex* from *WordStar*'s main menu.

StarIndex creates three files: an index, a table of contents, and a file containing your manuscript complete with numbered sections. Using *WordStar* again, you can change anything that didn't turn out exactly as you wanted and then print *StarIndex*'s files.

What if you need to use *StarIndex* on a manuscript that's stored as multiple files? No problem. *StarIndex* recognizes .FI, the *MailMerge* command that chains files together. If your files are on different disks, you can use the *change* command to make the program pause while you switch disks.

Indexing. Index entries can come from two sources: words and phrases already in the manuscript and those you supply because they don't appear in your text exactly as you want them in the index. You can indicate the principal treatment (main entry) of a subject by having its page number boldfaced in your index; more general entries appear in regular print.

To index a word that's already in your text, you embed a command just as you would a *WordStar* boldface or underline command. For example, to indicate the main entry for *computer*, you type ∧P∧P on each side of the word *computer*. Similarly, you set off general entries with ∧P∧K.

Dot commands allow you to index a term that's not in your text exactly as you want it to appear in the index. On the line that precedes the passage you want indexed, you type .IM to designate a main entry and .II to designate a general entry. If you want to be more specific, you can use subentries. A comma placed after the main entry tells *StarIndex* that what follows is a subentry. For example, if you wanted *WordStar* to be a subentry under the entry *Word Processors*, you'd type *.II Word Processors, WordStar.*

StarIndex limits entries to eighty characters. You can index terms that cross over lines or pages but not those that extend past a hard carriage return. Fortunately, if you forget the closing half of an embedded command (something that's easy to do), all isn't lost. *StarIndex* automatically cuts off the entry after eighty characters or at the next hard carriage return, whichever comes first. Without interrupting its run, it gives you a warning message to let you know what happened.

One thing to remember is that *StarIndex*, like other indexers, does *not* automatically find succeeding occurrences of a word or phrase once you mark the first occurrence—you must mark the term each time it appears in the text. But, to streamline the process, you can use *WordStar*'s search and replace functions to replace each occurrence of the term with *∧P∧Pterm to index∧P∧P.*

Automatic Section Numbering. *StarIndex* automatically numbers sections, appendixes, figures, tables, or practically anything else you want. Just enter the appropriate dot commands on the line preceding each heading to indicate whether it's a major heading, subheading, or whatever. For example, to designate a chapter title as a major heading, you type .IA on the line preceding the title.

You can have up to four heading levels. The numbering format defaults to Arabic numerals (from 1. for major headings to 1.1.1.1 for lowest-level headings), but many other options are available.

Automatic Table-of-Contents Generation. Once you've numbered the headings in your text, why not have them automatically printed as a table of contents? That's exactly what *StarIndex* does. It locates any headings that you've designated for section numbering and enters them in a table of contents. Your headings print exactly as they appear in the manuscript (including the same numbering and printing format), along with the appropriate page number.

StarIndex limits contents entries to one line, but that line can have up to 255 characters. If you want your table of contents to be more than a simple list of headings, you can use dot commands to insert extra text—a brief summary of each chapter, for example.

In the same way that you mark headings for a table of contents, you can mark the legends of figures and tables to produce a list of

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figures or tables. As it does with section headings, *StarIndex* automatically numbers the legends in your text.

Formatting. *StarIndex* gives you plenty of formatting options. You can decide how to number headings and pages, what titles to give tables and indexes, and what print features to use for each. Table 1 lists these formatting options.

There are two ways to specify a formatting option. You can have a format stay associated with a document or you can save a format in a separate file. To do the first, you embed dot commands in the text; to do the second, you call on a menu-driven program named Style. The latter approach allows you to create multiple formats and choose the appropriate one for each manuscript.

StarIndex's Formatting and Printing Options

Headings

Numbering:
- No numbering
- Arabic numerals
- Roman (upper or lowercase)
- Letters (upper or lowercase)
- Omit or print higher level numbers

Printing:
- Regular print
- Boldface
- Double-strike
- Underline
- Spacing
- Elongated (dot-matrix printer only)
- A combination of the above

Index

Index automatically generated each time you run *StarIndex* Y/N
Letter headings included in index Y/N
Headings automatically indexed Y/N

Table of Contents

Page Numbering:
- No numbering
- Arabic numerals
- Roman (upper or lowercase)

Omit or print higher level numbers
Use same print options as for headings Y/N

Titles and Captions

Rename titles or captions (for example, change List of Figures to List of Illustrations)

Table 1.

For maximum flexibility you can combine dot commands with the instructions of a Style format file, since dot commands always take precedence over Style commands. This means you can insert a dot command or two in your document when you want a printout that's slightly different from what you'd get with a Style format file.

Documentation and Support. MicroPro has done an outstanding job on *StarIndex*'s documentation. The 111-page manual includes sample screens and printouts as well as helpful hints on how to get the most from the program. A handy quick-reference card helps you keep the commands straight. There's also a sample document on disk for you to practice with.

Ease of Learning and Use. Since *StarIndex's* commands are similar to *WordStar*'s (you know, mnemonics such as .IE for fIgurEs), *WordStar* veterans should feel right at home. However, even though you can throw out your index cards, using *StarIndex* isn't as automatic as you might like. It still leaves a fair amount of the work to you.

Audience. Anyone who uses *WordStar* for long documents such as manuals, briefs, business reports, or books will find *StarIndex* valuable.

System Requirements. 48K.
Punctuation + Style (version 1.21)
Oasis Systems
2765 Reynard Way
San Diego, CA 92103
(619) 222-1153
Price: $150

StarIndex (version 1.0)
MicroPro International Corporation
33 San Pablo Avenue
San Rafael, CA 94903
(415) 499-1200
Price: $195

UPDATES

VisiWord. The news about *VisiWord* is that it's now bundled with *VisiSpell*, and, reflecting the change, the new package is called *VisiWord Plus*. The price, however, hasn't changed, so in effect you get *VisiSpell* (previously $225) for free.

In addition, VisiCorp has just released a new version of *VisiWord* (version 1.2) that includes:

Bug fixes. VisiCorp says they've tamed the wayward cursor and increased *VisiWord*'s screen-painting speed, so it's less likely that you'll outtype the cursor. They've also improved the DOS file-conversion program. In previous versions, this program went overboard when it removed a centering command, taking the rest of that line with it.

New print drivers. Print drivers have been added for the C. Itoh Starwriter and IBM Electronic Typewriter, models 65 and 85.

WordPerfect. SSI, like VisiCorp, is now offering its word processor and spelling checker as one package without a price increase. They've also released a major update of *WordPerfect* (version 3.0, available to *WordPerfect* users for $20), and it's a dandy. Version 3.0 adds many features to the version reviewed here in September, including:

More rapid screen rewriting. A "flash" version of *WordPerfect* that's specific for the IBM rewrites the screen three times faster than previous versions.

Proportional spacing. WordPerfect now supports proportional spacing. It places a code in your file so your document will be proportionally spaced each time you send it to the printer.

File protection. WordPerfect can scramble (encrypt) your document so that, to an unauthorized person, it will appear as a jumble of characters on-screen. To unscramble it, you have to use a password that can have as many as seventy-five characters. The password is *not* saved on disk, so if you forget it you're out of luck—unless your hobby is solving ciphers.

Orphan and widow control. A widow is a last line of a paragraph isolated at the top of a page. An orphan, on the other hand, is the first line of a paragraph that's printed by itself at the bottom of a page. *WordPerfect* now automatically prevents these unsightly creatures. One-line headings and paragraphs of less than three lines aren't protected, however, so you still need to use a conditional end-of-page command for these.

A file-conversion feature. WordPerfect now has a utility that converts *WordPerfect* files to standard ASCII text files. This allows *WordPerfect* to function as a program editor. Conversely, you can convert standard text files to *WordPerfect* format. There's also a command to convert *dBase II* address files to *WordPerfect* format so they can be used with a mail-merge feature.

Extended characters. You can have special characters displayed on-screen (and printed) by using alt- or control-key combinations.

Improved editing. You can now edit in the "reveal functions" mode, the mode in which *WordPerfect* displays its normally hidden printing and formatting codes. This makes deleting these codes much easier.

Improved hyphenation control. You can turn hyphenation on or off for the current session or change it permanently by altering the default setting. With hyphen help on, you can now bypass hyphenating a particular word and have it wrapped to the next line instead.

Expanded printer support. A menu-driven program now allows you to interface printers that aren't on *WordPerfect*'s list of supported printers. ▲

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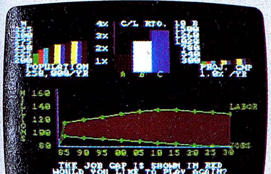

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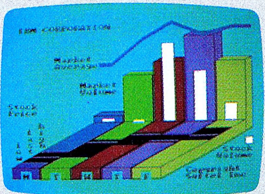

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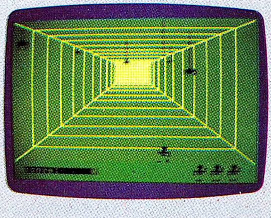

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TALE of the PORTS

by John Dickinson

The Oracles of EBCDIC were enjoying a pleasant evening, chatting about their recent visit from the King of ASCII. "Nice fellow, that aSC," said IBlue.

"Yes," agreed MBlue. "Too bad about his trouble over the Escape."

aSC, you may remember, had consulted with the Oracles when the HardWares and SoftWares of ASCII couldn't agree on how to celebrate their Great Escape from the chains of TTY ("The Printed Word," November 1983). Even to a great King like aSC the problem had seemed insolvable, but to the Oracles it was just another ho-hum matter in the World of Computers, and they had easily solved it for him.

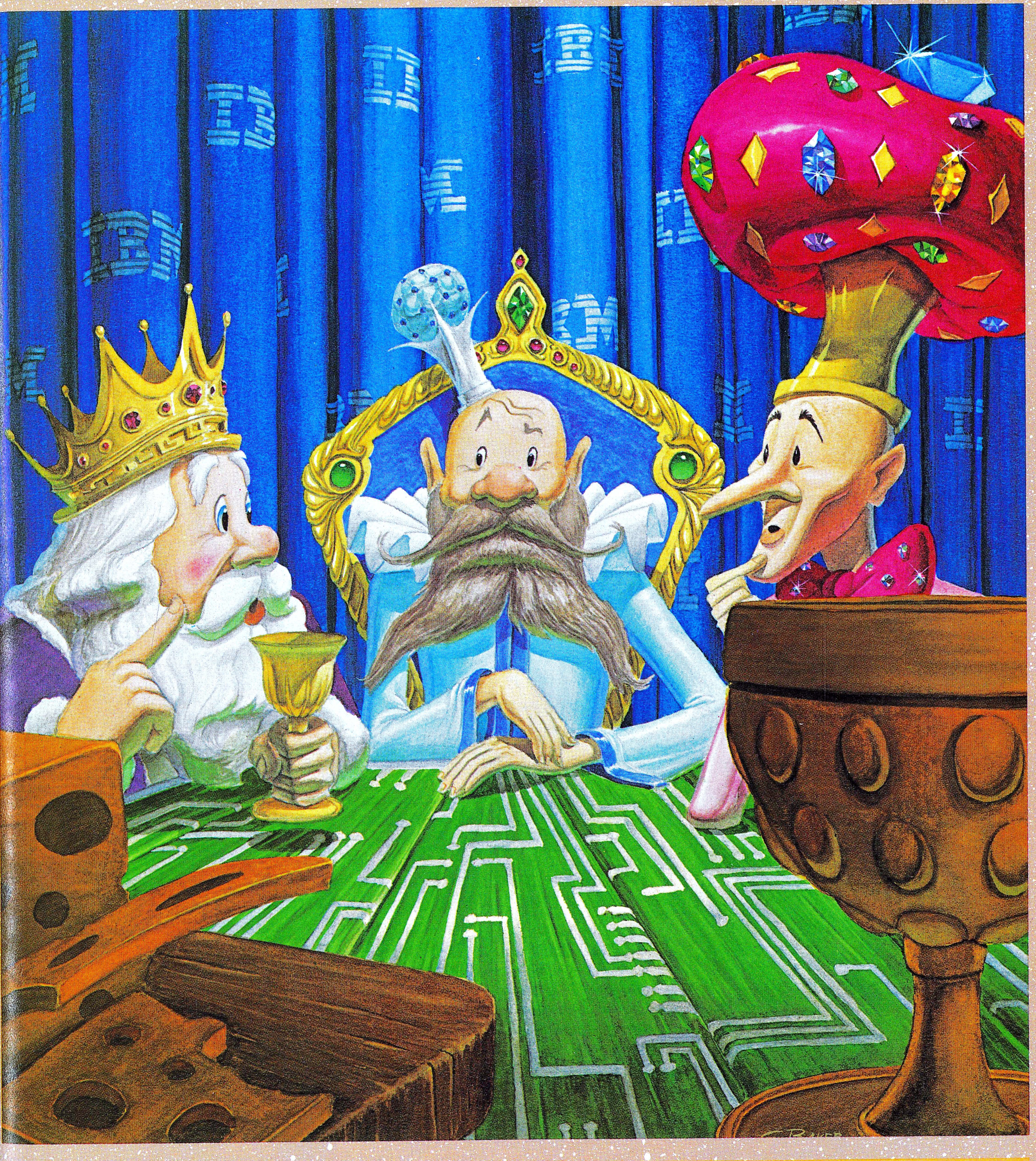
"Perhaps we should pay more attention to affairs in ASCII," said IBlue.

MBlue didn't agree. "ASCII is of no importance to the Kingdom of EBCDIC," he said. "It is incompatible in most respects."

"But what of the popular shacks and arcades of ASCII?" asked IBlue. "Shouldn't we pay more attention to that sort of thing?"

"Maybe we should, at that," said BBlue. After a few moments, an idea struck him. "My youngest son, PCBlue, has been at loose ends lately, with nothing to do. We'll send him to ASCII to have a look at things there."

So it came to pass that PCBlue was sent to live in the Kingdom of ASCII. His father cautioned him about his mission. "Don't make a big fuss about moving to ASCII," BBlue said. "We don't want to disturb things there, just observe them."

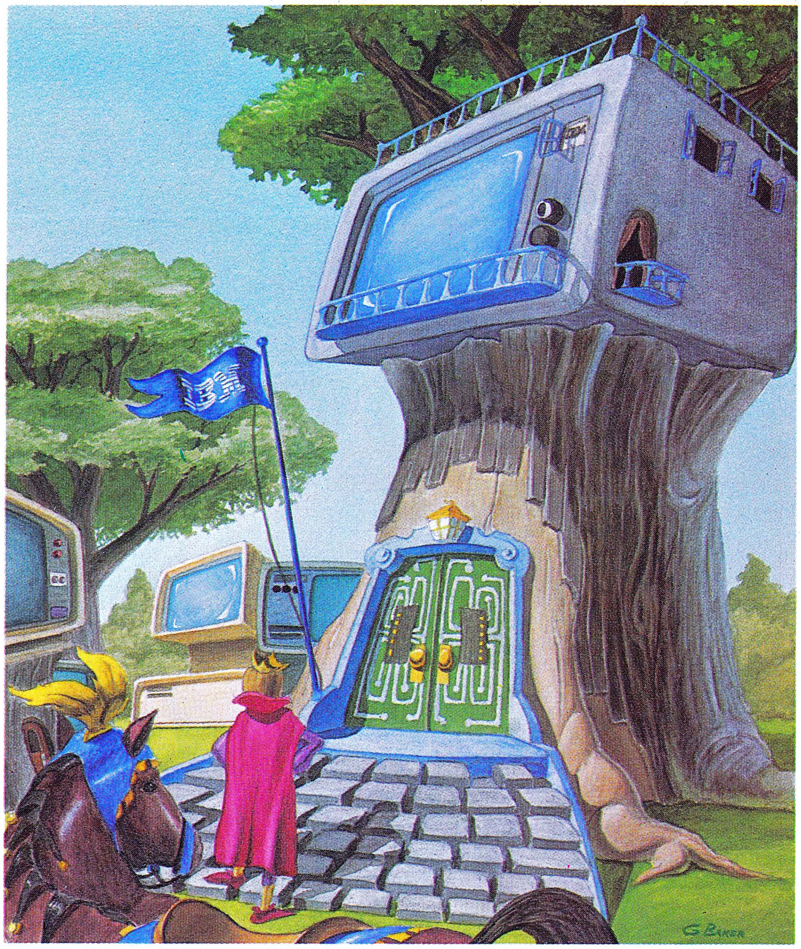


'But what of the popular shacks and arcades of ASCII?' asked IBlue. 'Shouldn't we pay more attention to that sort of thing?'

Illustrations by Gordon Baker, Tennesen/Tobin Studios

PCBlue's first task upon arriving in ASCII was to build a house to live in. He was astonished by the small size of most of the other houses there. "We normally have 64K," he was told by neighbors, "although the Rube of SoftWares can make trick houses of as many as 128K."

PCBlue was not satisfied with this and wanted something larger. In EBCDIC, you see, even the smallest houses had 256K, and palaces of 16M and even 96M were not unheard of. So, with the help of a distant cousin from the Valley of Silicon, PCBlue built a special house of 1,024K in ASCII.



So, with the help of a distant cousin from the Valley of Silicon, PCBlue built a special house of 1,024K in ASCII.

◆

The citizens of ASCII were awed by the size of PCBlue's new house—their shacks and arcades paled by comparison—and they were a little afraid of it, too. The Kingdom of EBCDIC, it seems, had an unsavory reputation in certain parts of ASCII, and people weren't quite sure what to expect from PCBlue or his great house.

But PCBlue reassured them. "My house is an open one," he said. "It has plenty of ports to use for whatever you want, and anyone in ASCII can use them to come and go as they please."

The great house did seem to be quite open. From the outside it appeared to have 64K ports, and that was quite a lot by anyone's standard. The citizens of ASCII were relieved—maybe these EBCDICs weren't such bad folks after all.

Citizens of ASCII proceeded to use the ports pretty much as they pleased, and PCBlue didn't mind at all. Oh, he was a bit taken aback when someone came in with joysticks and pong balls, and he wondered how a mouse might be used, but he stuck to his open house policy. He was well pleased with the asynchronous communications adapters (especially the one with an automatic modem) and was particularly proud of his new quartz clock and calendar. There seemed no limit to the number of ports or to what citizens of ASCII would think of next.

However, there had been one slight problem with the house's ports during its construction. PCBlue's cousin had designed the house to use all the 64K ports that appeared on the outside, but the Zoning Board of ASCII had other ideas. "Local laws allow only 1,024 ports," they had told PCBlue. "You must shutter the rest of them off."

Appeals to aSC for help had been in vain. "Bureaucrats of ASCII have their own ways, just like bureaucrats anywhere else," lamented aSC, "and there's nothing I can do about it." For the moment, there seemed to be enough ports to go around, so PCBlue let the matter rest.

One day, BBlue decided to make the long journey to ASCII to visit his son. When he arrived there, he was tired, shaken, and a bit miffed. "How can I make a decent trip here on these old asynchronous communications links?" he complained. "It's start-stop all the way, and my slick new 3279 color terminal wouldn't even fit on the lines! I had to park it and rent some silly portable thing with rubber ears!"

PCBlue was somewhat embarrassed, but he reminded BBlue of his own instructions. "You told me not to disturb things here," he said, "and all communications in ASCII are done on asynchronous links. We must do the same."

"We can fix that!" replied BBlue. "I'll build a nice, smooth bisynchronous link from EBCDIC to your house in ASCII." That seemed like a nice idea to PCBlue—he missed visiting with his friends in EBCDIC.

The rest of BBlue's visit seemed to go quite well. He praised PCBlue's new house and liked everything about it. Until, that is, PCBlue took him in to see the disks. *"Floppy disks?!"* BBlue was livid. "No son of mine is going to live in a house with just floppy disks!"

"But all houses in ASCII have floppy disks," said PCBlue, once again recalling BBlue's orders.

"Never mind that," said BBlue. "We'll have the monks at Winchester build a nice fixed disk for your house. Floppy disks, indeed!"

And so it was that almost before it was finished, the nice new house that PCBlue had built in ASCII started to be reconstructed. Specialists were brought in from EBCDIC to work on the bisynchronous link, and a new expansion annex was fabricated for the fixed disk.

The people of ASCII once again were astonished by PCBlue's house, this time by all the changes. Never had they seen such speedy communications, nor at such great cost. And the fixed disks of Winchester were but a pipe dream for all except the richest citizens of ASCII.

PCBlue again reassured them. "My house is still an open one," he said. "A few of the ports had to be used for the new additions, but the rest are still free for you to use however you want to."

But the "few" ports used turned out to be many, and trouble soon began. It started when PCBlue's quartz clock stopped working. He went to see what was wrong and found out that the clock had been damaged. The fixed disk, it seems, was using the same port, and every time the disk was accessed it hit the clock. After a few days, the clock had broken completely. Another gadget, this one a special asynchronous communications device, stopped working altogether. The expansion annex had taken the ports that it had been using and had blocked them off.

PCBlue carefully moved his clock to another port and refitted the asynchronous device. But the incidents aroused great concern in ASCII. The citizens wondered how many ports PCBlue's house really had. How many of them were really open for use? Where were they? Most

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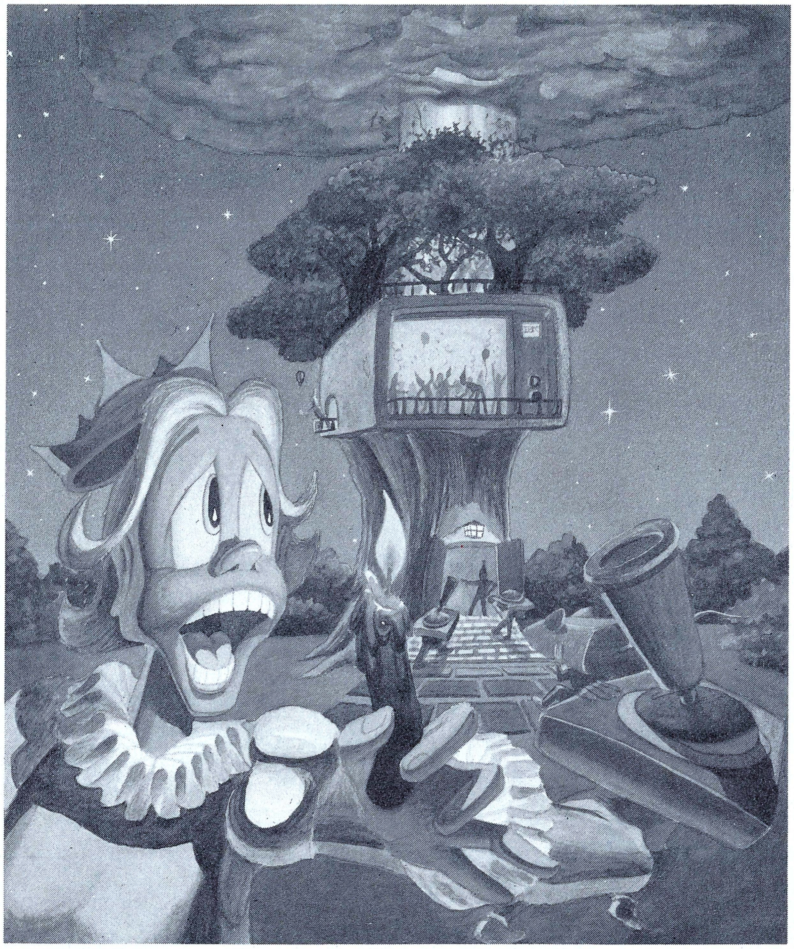
of all, when would PCBlue's father decide to add something else from the Kingdom of EBCDIC that would use up more of the ports?

* * *

A fable and a fairy tale both tell a fanciful story; the difference is that a fable's purpose is to make a cautionary point. What you've just read is a fable. Its cautionary point is that the PC has a limited number of input/output ports available for use by optional expansion devices, and that they are being used up at a rapid pace—by IBM and every other vendor that is busily adding options to PCs.

This may not mean much to you if you don't know what an "input/output port" is or how one is used, so let's start there. Once we've established what ports are and how they work, we'll take up the questions of how many the PC has and how IBM has used them; we'll examine the port situation both before and after the XT enhancements (fixed disk, expansion cabinet, and bisynchronous communications links) and the more recent 3270-PC and PC-XT/370 introductions. While we're at it, we'll also explore how third-party (non-IBM) options that you may have installed or be thinking of installing on your PC could be using the ports.


He was a bit taken aback when people came in with joysticks and pong balls, but he stuck to his open house policy.

Designing a computer involves many choices. Some of the considerations—such as register size, number of registers available and the uses to which they can be put, instruction set, maximum random memory available to the processor, and the data size and addressing scheme used for accessing memory—have to do essentially with internal goings-on; these choices involve concepts that are fairly well understood.

A design area that's less widely understood has to do with communications between the computer and the outside world. How will the designer arrange for the flow of information into and out of the system?

It's easy enough to decide to use keyboards, disk drives, printers, and video displays for these purposes; such input/output devices are part of the standard armamentarium of current computer technology. It's also no problem to decide to use intelligent device controllers to manage the I/O devices; these controllers free the central processor from worry about such mundane matters as how far a track is from the edge of a floppy disk or how far from the top of a video screen a display line is. Intelligent controllers greatly reduce system overhead.

What's less obvious is the decision about how the processor will *find* the I/O devices. Where should it look for data once a disk drive or keyboard controller has made it available? And to what address should it send data on its way to an output device?

As it turns out, a computer designer can answer these questions in either of two ways. He can reserve portions of ordinary system memory (RAM) for the use of input and output devices, or he can designate a special type of address, one that isn't in RAM, for the use of I/O devices. If he takes the latter approach, he creates a set of exclusive addresses called *I/O ports*; the entire neighborhood of such addresses is called an *I/O address space*.

Reserving ordinary RAM for I/O devices makes things easier in some ways and more hazardous in others. The same data-movement instructions (the 8088's MOV, for example) can be used to transfer information both into or out of ordinary memory and into or out of an I/O device (the cost of such convenience is that some of the system's memory becomes unavailable for general use); but it's possible that data intended for storage in RAM may inadvertently be moved to an input or output device instead, causing destruction of a critical database or other adverse consequences.

Using a separate I/O address space is safer, but it's costly in another way. The danger of misdirecting data movement is eliminated by this approach, because special processor instructions have to be developed that inform the system that the data are intended for movement to or from an I/O device, not to or from RAM. But therein lies the penalty. The additional instructions required have to be added to what is usually a very limited resource, the computer's instruction set. The instruction set is contained in read-only memory inside the processor, and its size is limited by both space constraints and the processor's own addressing scheme.

In designing the 8088, Intel opted for the second approach. The processor (and therefore your PC) has separate I/O ports in their own I/O address space, and includes extra instructions—*in* and *out*—that allow you to access these ports. The separate I/O address space works just like regular RAM, except that a signal change, generated by the *in* and *out* instructions, informs the processor's data bus controller that the data are moving to or from an I/O port. (It's possible that this design influenced IBM's selection of the Intel chip, since the company generally favors separate I/O ports in its mainframe computers.)

The 8088 does not address its I/O ports in exactly the same way as it addresses its ordinary memory. The segmentation scheme that yields a twenty-bit address and makes 1,024K (two to the twentieth power) of RAM and ROM available on the PC is not used for port addressing. Only sixteen bits are used to compute the I/O address. This means that the 8088 can theoretically address 65,536 (two to the sixteenth power) I/O ports.

However, the PC's implementation of the 8088's I/O port addressing scheme does not use all sixteen available address bits; it uses only the first ten. The other six bits are ignored (or, in computer lingo, sent to the "bit bucket"). This limits the I/O address space of the PC to 1,024 (two to the tenth power) ports, whose addresses are 000H through 3FFH.

Physically, the 1,024 ports on the PC fall into three categories: those available only on the system board, those available only in the I/O channel (the PC's five expansion slots make up its *I/O channel*), and those available in both places. Ports with addresses 000H through 0FFH are available exclusively on the system board, port addresses 100H through 1FFH are available on both the system board and in the channel, and addresses 200H through 3FFH are available exclusively in the I/O channel.

Only those ports available in the I/O channel can be used for expansion purposes. Looking at the addresses in the previous paragraph, you might conclude that a total of 768 ports are available for expansion. That would be a reasonable but inaccurate conclusion.

It turns out that, for reasons unstated by IBM, ports with addresses 100H through 1FFH have an odd implementation restriction. Even though they're available in the I/O channel (as well as on the system board), these ports may be used only for *output* on the channel. And there are no output-only devices in use on modern computers. Even those devices, such as printers, whose only apparent function is output, send acknowledgment and status signals back to the computer. The restriction on ports 100H through 1FFH makes them virtually useless for expansion purposes; although on the system board they're fully functional, the ports are not currently used there either.

So, rather than having the 65,536 I/O ports that are theoretically possible on 8088-based machines, the PC has but 1,024. Only 768 are really usable (unless IBM decides to implement more I/O addresses on the system board or rewires the I/O channel to allow full use of the restricted ports), and only 512 of the I/O addresses can be used for expansion devices. (Reading the technical reference manuals on this point can be confusing. The original IBM manual states, on page 2-8, that 512 I/O ports were available in the I/O channel. The manual's 2.02 revision, which includes coverage of the XT enhancements, states, on page 1-14, that there are 768. The difference is that the 2.02 revision documents the availability of the ports in the 100H through 1FFH range.)

A priority system governs the use of I/O ports on the PC.

The highest priority level is for devices that the system cannot function without. These include its internal timer, the interrupt controller, the programmable peripheral interface (PPI) chip (which includes the keyboard's access), the direct memory access (DMA) control chip and registers, and the nonmaskable interrupt (NMI) registers. All these devices are located on the PC's system board and are in the lowest range of I/O addresses (000H through 0FFH).

Next in the priority list are devices that PC users cannot, or do not wish to, function without. Included in this tier are video display controllers, the disk-drive controller, and usually a parallel printer adapter. The XT's fixed-disk controller and primary asynchronous communications adapter are included in this priority level, and so is the IBM expansion cabinet controller, on systems so equipped.

IBM has specified I/O addresses on the PC for the devices in these two priority levels (see the technical reference manuals for documentation). All the devices in this priority class are located on expansion boards mounted in the I/O channel and are in the address range 200H through 3FFH.

The lowest priority of I/O port allocation goes to optional devices. All optional devices are located on expansion boards. The range and use of optional devices is seemingly endless and includes everything from bisynchronous and asynchronous communications adapters to light pens and tablets. More recently, mice have appeared on the scene. With the exception of the 8087 numeric data processor, all coprocessor devices (such as the 8080 add-on processors, the QuadLink 6502 Apple II emulator, and IBM's own XT/370 triprocessor) have to be accessed as optional I/O devices.

Some of these devices have been included in IBM's specifications of port allocation. For example, space is reserved by IBM for the game controller and communications adapters. I/O address space also is allocated to a "prototype card" for use by option developers and hobbyists. Other devices may go wherever their designers choose to put them, as long as there is room in the I/O address space at the addresses chosen by their designers.

The fact that your PC has 512 I/O ports available for optional devices doesn't mean you can attach 512 I/O devices to it. There are two reasons for this. One is that most I/O devices consume more than a single address. Devices usually require a block of I/O ports, each of which is assigned to a distinct component (usually a register) of the device or its controller. The other reason is that IBM has reserved many I/O ports for future use, and it is wise not to place devices at those reserved positions. (Two reasons for that: You might want to attach a new device for which space has been reserved when the device becomes available; and, in the World of Computers, "reserved" occasionally means "in use for undocumented purposes." Sources at IBM indicate that none of the reserved I/O addresses are currently used, but it's best to be cautious.)

To get an idea of what all this may mean to you, let's look at how IBM has allocated the I/O address space of the PC, including its reserved address blocks; then let's check out a few devices to see how they fit in. Tables 1 through 3 are maps of the three usable blocks of I/O ports. Table 1 shows the system board addresses (000H through 0FFH), and tables 2 and 3 cover addresses 200H through 2FFH and 300H through 3FFH respectively. The maps do not include addresses 100H through 1FFH, since these ports are neither currently used on the system board nor usable in the I/O channel.

Allocated ports are captioned on the maps with their assigned functions, and empty cells represent ports currently unallocated by IBM. Shaded areas denote the allocations (including the new space reservations) that IBM added with the XT enhancements, and checkered areas represent the allocations that IBM added with the XT/370 and 3270-PC enhancements. Allocations for the PC*jr* are not shown, because Junior uses an altogether different I/O space.

One thing you'll notice right away is that the I/O address space was much less crowded before the XT and the newer machines came along. On the original PC, only 200 I/O ports were used or reserved for future use. This represented about 26 percent of the total ports available. Of

	0H	1H	2H	3H	4H	5H	6H	7H	8H	9H	AH	BH	CH	DH	EH	FH
000H	DMA Chip - 8237-A															
010H																
020H	Int - 8259A															
030H																
040H	Timer 8253-5															
050H																
060H	PPI 8255A-5															
070H																
080H	DMA Page Regs															
090H																
0A0H	NMI Mask Register															
0B0H																
0C0H	Reserved															
0D0H																
0E0H	Reserved															
0F0H																

Table 1. IBM PC and PC-XT I/O address map: system board I/O address 000H—0FFH

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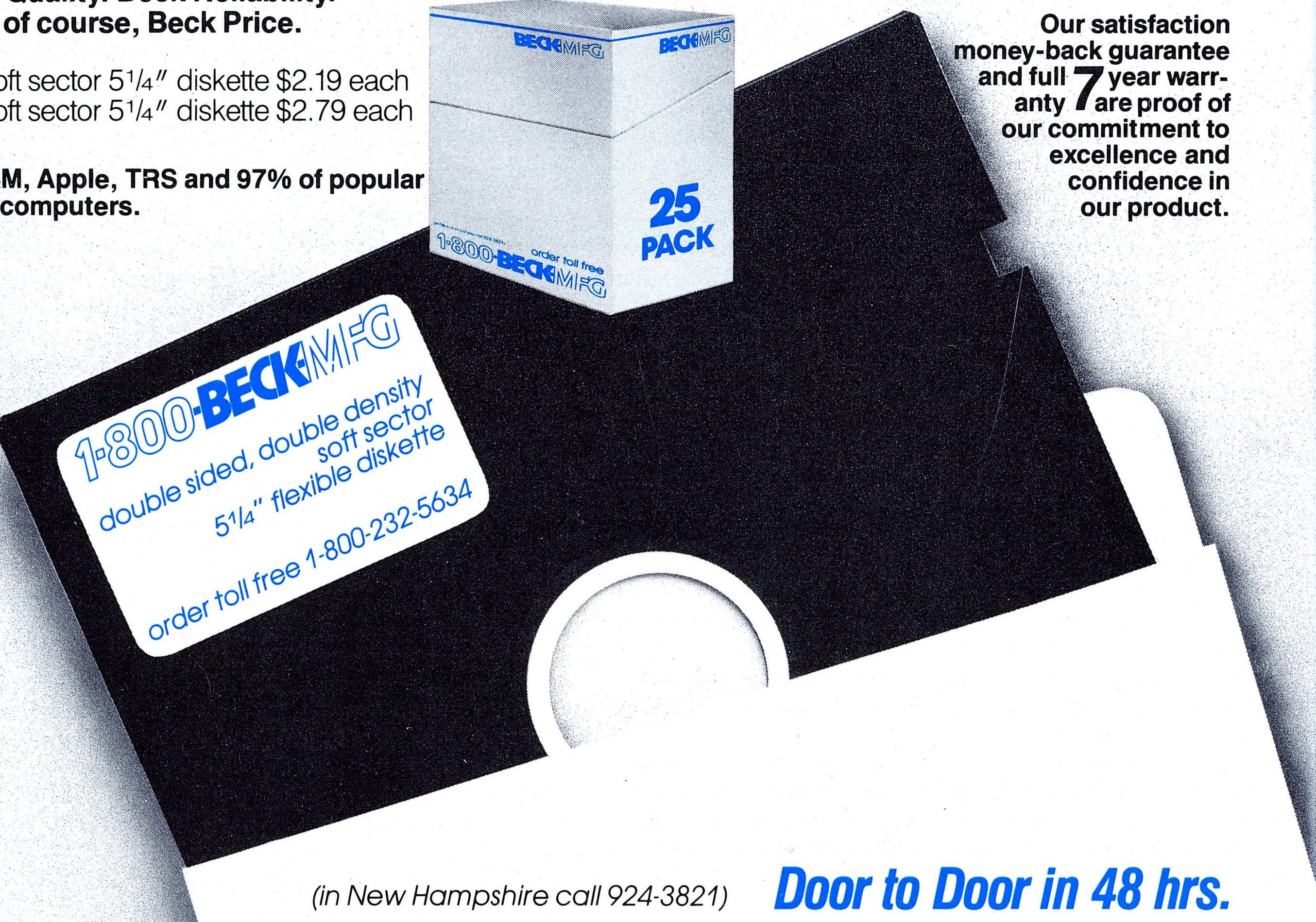
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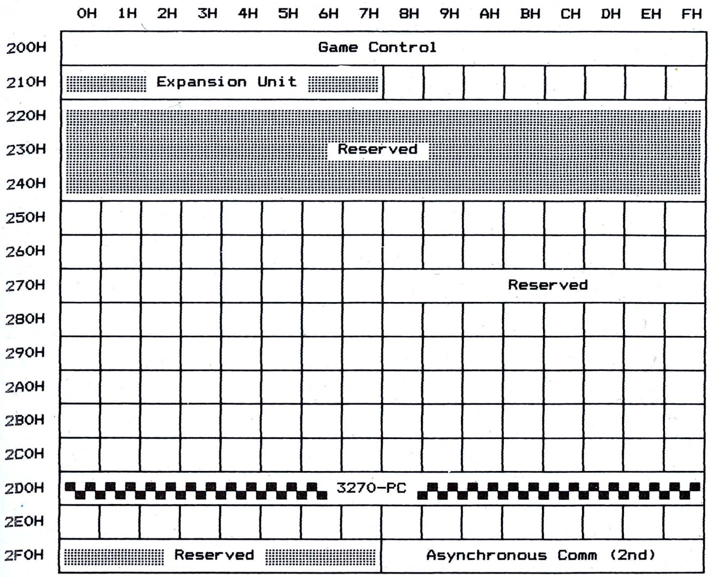
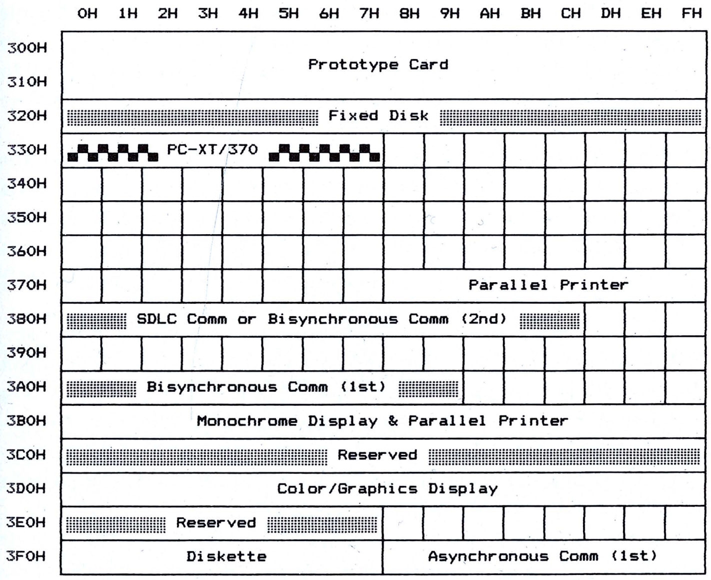


	0H	1H	2H	3H	4H	5H	6H	7H	8H	9H	AH	BH	CH	DH	EH	FH
200H	Game Control															
210H	▨ Expansion Unit ▨															
220H	▨ Reserved ▨															
230H																
240H																
250H																
260H																
270H									Reserved							
280H																
290H																
2A0H																
2B0H																
2C0H																
2D0H	3270-PC															
2E0H																
2F0H	▨ Reserved ▨								Asynchronous Comm (2nd)							

Table 2. IBM PC and PC-XT I/O address map: I/O channel I/O addresses 200H–2FFH



	0H	1H	2H	3H	4H	5H	6H	7H	8H	9H	AH	BH	CH	DH	EH	FH
300H	Prototype Card															
310H																
320H	▨ Fixed Disk ▨															
330H	PC-XT/370															
340H																
350H																
360H																
370H									Parallel Printer							
380H	▨ SDLC Comm or Bisynchronous Comm (2nd) ▨															
390H																
3A0H	▨ Bisynchronous Comm (1st) ▨															
3B0H	Monochrome Display & Parallel Printer															
3C0H	▨ Reserved ▨															
3D0H	Color/Graphics Display															
3E0H	▨ Reserved ▨															
3F0H	Diskette								Asynchronous Comm (1st)							

Table 3. IBM PC and PC-XT I/O address map: I/O channel I/O addresses 300H–3FFH

the 512 ports available for expansion, IBM used or reserved 120, or 23 percent, which left plenty of room for expansion devices.

The XT enhancements used, or reserved, an additional 127 ports, all of them in the I/O channel. The XT/370 consumes an additional eight ports, and the 3270-PC uses sixteen more. These are also in the I/O channel. A total of 351 I/O ports are now used by or reserved for IBM-specified devices, and 271 of these are in the I/O channel. Of the 512 ports available for PC expansions, IBM has used or reserved 53 percent. Table 4 summarizes the situation.

IBM's use of reserved ports is something of a mystery. The company originally reserved two sixteen-address blocks on the PC (0C0H through 0CFH and 0E0H through 0EFH), but it hasn't used them for any enhancements. (One additional block was originally documented as being reserved but was actually used for the secondary asynchronous communications adapter.) In the XT enhancement, IBM reserved several additional large blocks that have yet to be put to use. No further space reservations were made with the XT/370 or 3270-PC enhancements, but IBM did not use previously reserved space. A source at IBM would say only that "things are under development" for the reserved spaces.

To get a better feel for what goes on in the I/O address space, take a look now at the port usage assignments that IBM specifies for its asynchronous communications adapter (other vendors usually follow this standard). Table 5 shows how each of the eight reserved ports is used for each asynchronous adapter you have attached to your PC. The addresses listed are for the primary adapter; the secondary one uses the same layout, but starts at a different I/O address.

A total of eight I/O ports are used by the asynchronous communications adapter. This may seem like a lot of space just to call your PC club's bulletin board or The Source, but that's what the design requires. It is important to remember that IBM's asynch adapter follows the company's specifications for port usage and location and can therefore be considered a "sanctioned" device. Other devices you attach may not be so legal.

One of the most popular "nonsanctioned" devices attached to PCs is a real-time clock/calendar. Like any other I/O device, it requires ports. But, the clock/calendar you have may use more of your machine's I/O resources than you think. To show you how much, table 6 contains the I/O port assignments used by AST Research's clock/calendar (which may be considered typical of these devices). The table is an adaptation of the one published in the AST *MegaPlus Guide to Installation & Operation*.

The AST clock/calendar uses nineteen ports—just to tell you the time and date! The total span of the addresses used is actually thirty-two ports (2C0H through 2DFH), which means that thirty-two ports ought to be reserved for the clock/calendar. It isn't absolutely necessary to reserve this many, but it's usually a good idea to consider ports that are spanned by a device to be in use by the device.

The big difference between the asynch adapter and the clock/calendar is not in the number of ports used or the function of the devices but in the fact that IBM has allocated space for the asynchronous adapter but not for the clock. That means that you can rely on the placement and operation of an asynchronous adapter at the address specified, but not necessarily on the AST (or anyone else's) clock/calendar. For exam-

	Original IBM PC	PC-XT Enhancements	PC-XT/370 & 3270-PC Enhancements	Total
System Board	80	+ 0	+ 0	80
Percent (of 256)	31%	+ 0%	+ 0%	31%
I/O Channel	120	+ 127	+ 24	271
Percent (of 512)	23%	+ 25%	+ 5%	53%
Total	200	+ 127	+ 24	351
Percent (of 768)	26%	+ 17%	+ 3%	46%

Table 4. IBM PC I/O ports used or reserved by IBM

I/O Address	Function
3F8H	Transmit/receive buffer or LSB divisor latch
3F9H	Interrupt-enable register or MSB divisor latch
3FAH	Interrupt-identification register
3FBH	Line control register
3FCH	Modem control register
3FDH	Line status register
3FEH	Modem status register
3FFH	DLAB switch (sets function of 3F8H or 3F9H)

Table 5. I/O address assignments for the IBM asynchronous communications adapter

I/O Address	Function
2C0H	1/100000 of seconds
2C1H	1/100 and 1/10 seconds
2C2H	Seconds
2C3H	Minutes
2C4H	Hours
2C5H	Days of the week
2C6H	Days of the month
2C7H	Month
2C8H—2CAH	RAM—year
2CBH—2CFH	Not used
2D0H	Interrupt status register
2D1H	Interrupt control register
2D2H	Counter reset
2D3H	RAM reset
2D4H	Status bit
2D5H	Go command
2D6H	Standby interrupt
2D7H—2DEH	Not used
2DFH	Test mode

Table 6. I/O address assignments for the AST clock/calendar

ple, if the AST clock/calendar were installed on a 3270-PC, there would be an I/O address conflict, and something—the clock or some aspect of the 3270-PC—would not function correctly. (One example of this sort of address conflict became evident when XT owners with Quadram QuadBoards found their clock/calendars malfunctioning. The clock and the fixed disk were trying to cohabit certain I/O addresses. Quadram has since put in a change of address for its clock.)

When an engineer at IBM was asked if Big Blue knew of the conflict between the AST clock and the 3270-PC, his answer was affirmative. How did IBM find out? "The hard way," came the reply. "One of our internal test users for the 3270-PC stuck an AST board in and, well, you know the rest." No one, it seems, is immune from accidental address conflicts.

One other point should be made about I/O ports used or reserved by IBM. As the clock/calendar example illustrates, large blocks of I/O addresses are often needed for optional devices. If you look back at table 1, you'll see that prior to the XT enhancements, there were several large blocks in the I/O channel available for use by expansion devices. Now, the only large blocks of unreserved addresses remaining are from 280H through 2CFH and from 338H through 36FH. Several port-hungry devices such as the clock/calendar can make the I/O address space quickly disappear. Most users need not worry about the space reserved for the 3270-PC and XT/370, since they won't be using these machines, but space is tight regardless.

There's no point in complaining that IBM is "taking over" the I/O territory. The PC is their machine, and they have the right to place their I/O devices wherever they feel they'll function best (or wherever they'll fit well in the address space). In other words, IBM exercises the same engineering rights over the PC and the firm's other computers as do auto manufacturers over the cars they make. If there is a complaint to be registered, it's that IBM has reserved quite a bit of space that has so far gone unused in their enhancements.

Here's the moral of this story: If you add non-IBM optional devices to your PC, be sure they fit into an area of the I/O address space that is otherwise unused. If two devices attempt to share an address or a block of addresses, something will go wrong. Nothing will happen if you don't have the IBM device for which the space in question is allocated; if you add that device later, trouble will start.

Be aware that it's also possible to have two non-IBM devices competing for the same I/O space. You even need to watch out for conflict between IBM-made options; this *shouldn't* be a problem, but there is in fact one pair of IBM devices that conflict: The IBM SDLC communications adapter may not coexist on a PC with a secondary IBM bisynchronous communications adapter (see the I/O address map at 380H to 38CH).

Sometimes it will be easy to discover if you have a port conflict or are about to have one. Some device manufacturers (AST is a good example) clearly document the I/O addresses used by their options. Some also allow you to set I/O address switches to indicate where the device should go on your machine, and, if you make sure that you do not set them to be in conflict with another device, this flexibility can ensure that you'll have no conflicts. (IBM says it encourages switches in the design of expansion boards, but few manufacturers seem to follow the company's suggestion.) Other manufacturers do not publish the port addresses used by their devices, and it is often difficult to find out where these devices are located. Without this information, your only option is to install the device and find out the hard way.

You may find it useful to make an I/O address map of your own PC, similar to the one printed here, and mark off the addresses used by options you have installed. This can be particularly important if your machine is "loaded" with options. You don't have to include extra RAM, but you do have to account for everything else, including coprocessors, mice, and devices for which space has been allocated by IBM but which your manufacturer has located in a different place.

Whatever else you do, be aware that if you add a gadget to your PC and it doesn't work, or if something that used to work no longer does, your problem may be an I/O address conflict. Look there first—BBlue may have reserved the room! ▲

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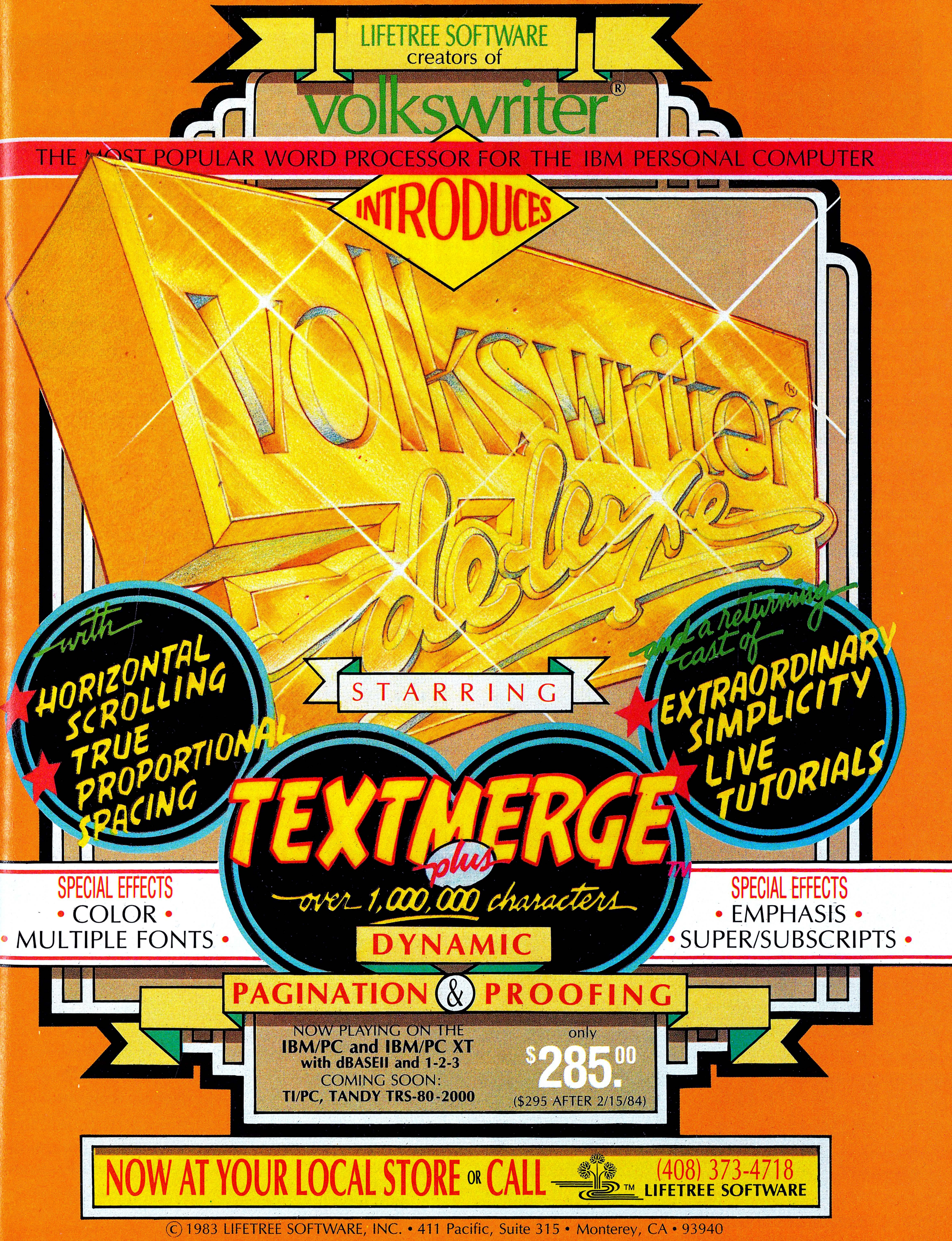

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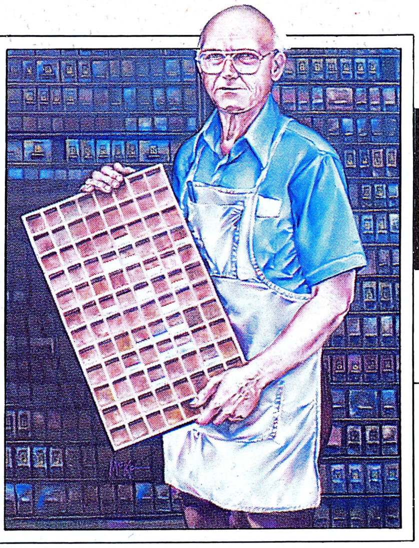
The Printed Word

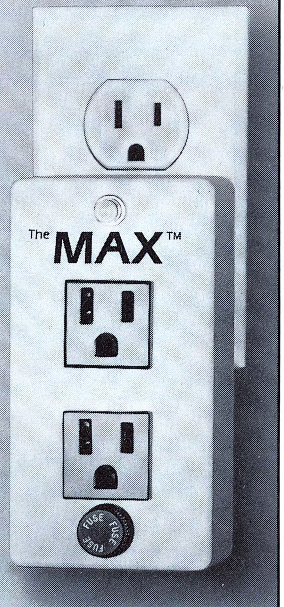
by John Dickinson



The Intelligent Printer, Part IV

If you followed the exercises presented in last month's column, you're well on your way to having a handy reference card for the features of your printer. You've organized your printer's features by functional category; now you can finish the reference card by adding to it the command sequences that activate your printer's features. These command sequences make up the language you'll need to communicate with your printer. Your printer's language is spelled out in your manual, but it may be hard for you to decode; this month's column will help you do that.

If you're just joining us now, or if you don't have last month's column handy, refer to table 1. That's where we left off; table 1 is the same as last month's table 4. The features listed there may very well not match those of your printer; we used an early-model Epson MX-80 as an example.



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Esc 9	FORMOUT	Enable Paper-Out Switch
	Forms Control	
FF	FORMFEED	Form Feed
Esc C	FORMLINE	Set Forms to "N" Lines
	Vertical Line Feed Control	
LF	LINEFEED	One Line Feed
VT	VT	One Vertical Tab
Esc B	SETVT	Set Vertical Tabs at "N1,N2,,,etc."
Esc 2	SPC6LPI	Set Line Feed at 6 LPI
Esc 0	SPC8LPI	Set Spaces at 1/8" (8 LPI)
Esc 1	SPC10LPI	Set Spaces at 7/72" (10 LPI)
Esc A	SPCN72	Set Line Feed "N"/72"
	Horizontal Head Control	
CR	CR	Carriage Return
HT	HT	One Horizontal Tab
Esc D	SETHT	Set Horizontal Tabs at "N1,N2,,,etc."
	Character Font & Print Control	
SI	COMP	Enable Compressed Characters (16.5 CPI)
DC2	XCOMP	Disable Compressed Characters
SO	WIDE	Enable Wide Characters (5 CPI)
DC4	XWIDE	Disable Wide Characters
Esc E	EMPHIZE	Enable Emphasized Characters
Esc F	XEMPHIZE	Disable Emphasized Characters
Esc G	DOUBLE	Enable Double-Strike Characters
Esc H		Disable Double-Strike Characters

Table 1. Epson MX-80 printer command sequences; functional area order.

Your printer's programming language is easily summarized. Its language consists of commands represented by ASCII characters according to the following syntax rules:

1. A character in the ASCII range 032 through 126 (the so-called

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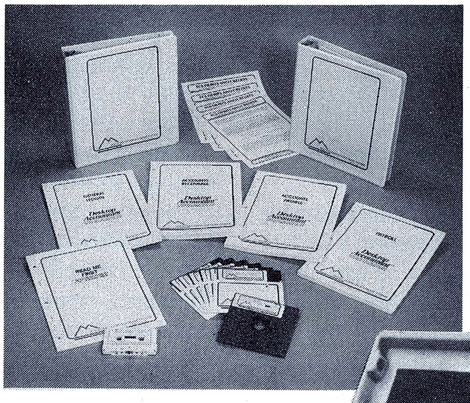

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printable range) is, normally, a command to print a character.

2. A character below the printable range (001 through 031) is, normally, a command to take a nonprinting action.

3. The escape character (ASCII 027) tells the printer that the character that follows is a command to take a nonprinting action, even though that following character might otherwise be a command to print a character. In other words, the escape character initiates an "escape sequence."

The punctuation rules for printer languages are even simpler than the syntax rules. Except for some relatively advanced command sequences used by a few printers (including the MX-80) that we won't get to this month, there are no punctuation rules for printer languages! All printing and nonprinting characters are sent from your PC to the printer as a continuous stream of characters, without punctuation or any other type of delimiter. Even those command sequences that do obey punctuation rules are expressed as a continuous character stream; the only difference is that some characters in the stream represent punctuation marks (a subsequent column will cover examples of this type of command sequence).

Your printer's language rules are quite simple, but there is a complication (how much fun would this be without one?): The sequences can be documented and used in four different formats, and, unfortunately, you need to learn all four.

Printer command sequences can be represented in the following ways:

- ASCII printable or control characters
- decimal ASCII character codes
- hexadecimal ASCII character codes
- terminal control codes

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The fourth format is rarely used in PC applications; it's relevant only for the one-character command sequences whose ASCII codes are 31 or lower. We won't cover the control-code format in detail, but you'll see how to derive it so you can use it when you need to.

Printer manuals document command sequences in any one (usually *only* one) of these formats. Application packages usually accept only one format, and their documentation in most cases uses the format they accept. Programming languages often accept more than one format for command sequences, but their documentation often uses only one for examples and may not even mention the possibility of using alternative formats. Worse yet, those language manuals that do present printer commands in more than one format often do so inconsistently, without giving you clear reasons for preferring one format over another.

Unfortunately, the command-sequence format appropriate for the applications or languages you use may not be the same as the one documented in your printer's manual. This is often a great source of confusion to printer users.

For all this apparent complexity, your printer is quite simple-minded—it understands command sequences only as ASCII character codes, and that's what you've seen in all previous installments of this column. (Actually, printers understand only the binary representation of ASCII codes, but this column has been presenting the codes in decimal notation for the sake of clarity.)

Since your manual may use one format and each of your applications a different one, you have to understand the meaning of each format and be able to translate command sequences from one to another. But don't worry; it turns out that the various command-sequence formats are merely different ways to represent the same ASCII character codes; translations from one format to another, moreover, are not difficult once you get the hang of it.

We're using the Epson MX-80 as an example in order to keep things simple. Let's start with its more elementary command sequences and work our way up to the more complicated ones. Once again, you can follow the example here, use your own printer's command sequences, or do both at once to be sure you get it all right.

Table 3 from last month is reprinted here as table 2; it shows the MX-80's command sequences for character-font and print-control. The one-character codes (listed at the top of the table) control the font (width) of the printed characters; they're the simplest command sequences, so we'll start with them.

The MX-80 user manual documents command sequences either as ASCII control characters or printable characters. The one-character command sequences are all control characters (they're in the ASCII range 001 to 031). To begin, we'll translate these command-sequence characters to their decimal ASCII character-code equivalents.

SI	COMP	Enable compressed characters
DC2	XCOMP	Disable compressed characters
SO	WIDE	Enable wide characters
DC4	XWIDE	Disable wide characters
Esc E	EMPHIZE	Enable emphasized characters
Esc F	XEMPHIZE	Disable emphasized characters
Esc G	DOUBLE	Enable double-strike characters
Esc H	XDOUBLE	Disable double-strike characters

Table 2. Epson MX-80 printer command sequences; character-font and print-control functional area.

A handy reference source for command-sequence translations is Appendix G of the Basic manual. There you'll find a full listing of the ASCII character set used on the PC, along with the equivalent decimal ASCII codes (they're called ASCII *values* in the table). Pages G-2 and

G-3 contain all the information you'll need for this part of the command-sequence translation (and lots more; if you're insatiably curious or can't sleep, you might want to study the whole table sometime).

Start by taking the characters listed in the left-hand column of our table 2 and write them down on a separate sheet of paper. These are the ASCII characters used in the MX-80's command sequences for character-font and print-control. Go to the table in Appendix G, find the decimal ASCII code to the left of each character, and then write it next to the character's name. Your new list should look like table 3.

ASCII Characters	Decimal ASCII Codes	
SI	015	
DC2	018	
SO	014	
DC4	020	
Esc E	027	069
Esc F	027	070
Esc G	027	071
Esc H	027	072

Table 3. Epson MX-80 printer command sequences; character-font and print-control functional area.

You're probably wondering what all the fuss is about; translating the command sequences from characters to decimal ASCII codes is easy. Going the other way (from decimal ASCII codes to characters) is equally easy. Try a few to see for yourself.

However, translating these command sequences into hexadecimal ASCII codes is not quite so simple, and translating hexadecimal ASCII codes into decimal and character equivalents is even less simple. Many printer manuals use hexadecimal ASCII codes in their command-sequence tables, so it's important to learn how to make these conversions. We'll do a thorough translation in each direction.

Once again the IBM Basic manual comes to the rescue, this time with Appendix H, which contains a hexadecimal conversion table. The table consists of pairs of columns containing hexadecimal values and their decimal equivalents. It's just a value translation table, much like the ASCII character-code table in Appendix G, and it's not difficult to use.

First we'll translate the decimal ASCII codes to hex. As you may know, the hexadecimal numbering system uses a base of sixteen and therefore requires sixteen digits. Hexadecimal takes its extra six digits from the first six letters of the alphabet. Thus, the number ten written in hex is A, eleven is B, twelve is C, and so on; the largest single-digit hex number is F, or fifteen. Hex digits 0 through 9 mean the same as they do in the decimal number system. If all this seems unnatural to you, don't worry; it seems that way at first to everyone who was born without sixteen fingers.

(The table on page H-1 omits a row for zero in the left column pair. Pencil one in if it makes you feel more comfortable.)

Concentrate for the moment on the first column pair of the table. It covers hex values 0 through F, or 0 through 15 in decimal notation. The first command sequence to be translated into hex is the SI character, which is decimal ASCII code 015. By inspecting the table in Appendix H, you can easily supply the hexadecimal ASCII code for SI:

ASCII Character	Decimal ASCII Code	Hexadecimal ASCII Code
SI	015	0FH

The translation is simple. Just look up decimal 15 in the first column pair of the table and translate it to F, its hex equivalent. Notice that we tacked a leading zero onto the hex ASCII code, along with an H. It's traditional to notate one-digit hexadecimal numbers with a leading zero—in other words, to write them as two-digit quantities. It's also traditional to add an H (sometimes as a subscript) or some other symbol to indicate that a number is hexadecimal, not decimal.

The DC2 character is a bit more difficult to translate than is SI. Its decimal ASCII code is 018, and all hex values greater than fifteen (0FH) require two digits, much as decimal values greater than nine do. So you have to learn to use the second column pair of the hexadecimal conversion table in conjunction with the first one.

To translate decimal 018 into hexadecimal, start by looking at the multiples of sixteen listed in the right half of the second column pair. Find the largest one that doesn't exceed 018. That's easy; the largest multiple of 16 less than 18 is 16—the first entry in the right half of column pair 2. By looking to the left of that entry, you can see that the hex equivalent of decimal 16 is 10. Now take the remainder of 18 minus

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16 (which is 2), find *that* value in the right half of column-pair 1, and look to *its* left to get the hex equivalent of the remainder. The hex equivalent of decimal 2 is, of course, 2. Finally, add the hex numbers you've found in column pair 2 and column pair 1 (10H and 02H) and you've got the hex equivalent of decimal 018—12H.

Let's look at this process in a more general way. To translate a decimal ASCII code (a decimal number between 0 and 255), you start by finding out how many sixteens the decimal ASCII number contains. This gives you the first (left) digit of the two-digit hex number that you're looking for. If the number of sixteens contained in the decimal number is greater than nine, then that left digit will be one of the letters A through F. After you've found the left digit, look at what remains after your division by sixteen; the remainder will give you your right digit.

All hexadecimal ASCII codes contain only two hex digits because there is no ASCII code greater than decimal 255. If you translate 255, you'll see that its hex value is FFH. To prove this to yourself, do the division as follows:

255 / 16 = 15; remainder = 15

Both the first and second digits are F, so the hex equivalent of decimal 255 is FFH. So the top half of the hexadecimal conversion table in Appendix H is all you'll need to translate your printer's command sequences. You can use the bottom half if you should ever need to translate larger decimal numbers into hexadecimal (or vice versa) for some other purpose.

You should now have enough information to complete your translation of the MX-80's character-font and print-control command sequences into hexadecimal notation, but let's do one more translation here, just for reinforcement. The escape character is so important to printer command sequences that you'll probably memorize both its decimal and hexadecimal values before long. The decimal ASCII character code for escape is 027. To derive its hex value, divide:

027 / 16 = 1; remainder = 11

The hexadecimal digit for eleven is B, so the entire hex value for the escape character is 1BH.

Now go ahead and do the remaining decimal-to-hexadecimal translations for the MX-80's character-font and print-control functional area. When you've finished, you should have something that looks like table 4.

ASCII Character	Decimal ASCII Code		Hexadecimal ASCII Code	
SI	015		0FH	
DC2	018		12H	
SO	014		0EH	
DC4	020		14H	
Esc E	027	069	1BH	45H
Esc F	027	070	1BH	46H
Esc G	027	071	1BH	47H
Esc H	027	072	1BH	48H

Table 4. Epson MX-80 printer command sequences; character-font and print-control functional area.

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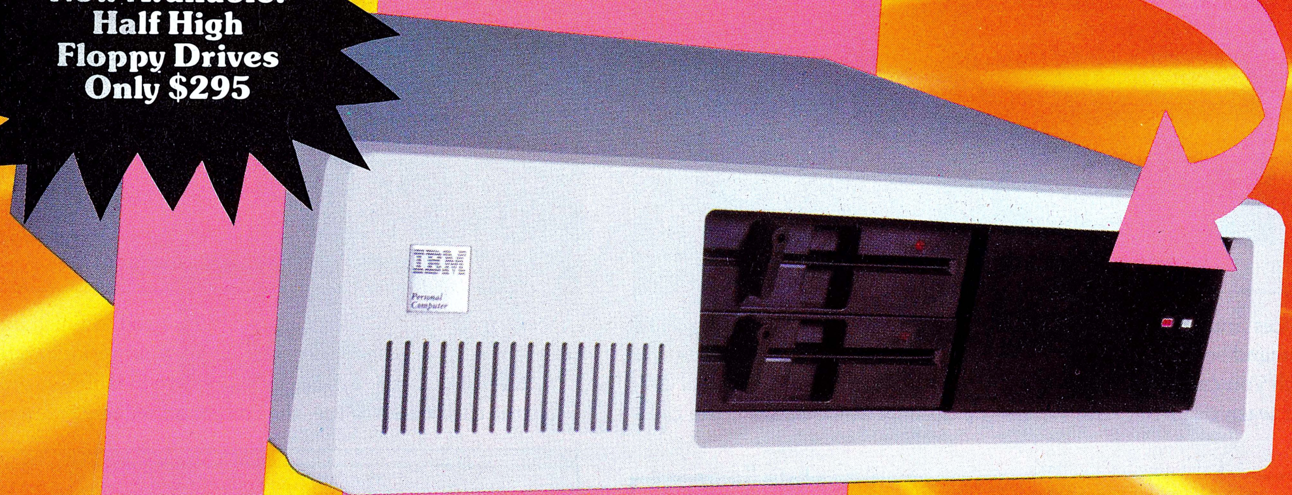

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The table for your own printer will be similar to this; exactly how it looks will depend on your printer's features and the command sequences used for them.

The information you have now should see you through the translation of the Epson MX-80's printer command sequences, but it may not get you through the command sequences for your own printer. That's because many printer manuals list command sequences in hexadecimal ASCII codes. So let's now do a few translations in the other direction—from hexadecimal to decimal ASCII codes, and from there to the ASCII characters those codes represent.

If the MX-80 manual had been printed using the hex ASCII codes, our table for the general print-control functional area (from last month's table 4) would look like table 5.

Once again, we'll start with the simple one-character command sequences and then work our way up to the more complex ones. The command sequence for sounding the printer's horn is hexadecimal 07, which you can easily find in Appendix H and translate to decimal 007. That wasn't difficult. But what's the decimal value of 18H, the command sequence for clearing the MX-80's buffer? To find out, look up each digit's decimal value in the appropriate column of Appendix H, and add these values:

Hexadecimal ASCII Code	Function
07H	Sound printer horn
18H	Clear printer buffer
1BH 38H	Disable paper-out switch
1BH 39H	Enable paper-out switch

Table 5. Epson MX-80 printer command sequences; general printer-control functional area.

	Hex	Decimal
First digit	1	16
Second digit	8	8
Total	18H	24

The decimal ASCII code equivalent to 18H is 024. If you need to find the character code that's equivalent to ASCII code 024, just return to Appendix G of the Basic manual. You'll find that ASCII 024 is the CAN (cancel) control code. If you continue translating the MX-80's general print-control command sequences from hexadecimal to decimal, you'll come up with something that looks like table 6.

Hexadecimal ASCII Code	Decimal ASCII Code	ASCII Character
07H	007	BEL
18H	024	CAN
1BH 38H	027 056	Esc 8
1BH 39H	027 057	Esc 9

Table 6. Epson MX-80 printer command sequences; general print-control functional area.

Now you have all the equipment you need to finish adding printer programming language information to your printer reference card. The completed card for the MX-80 is shown in table 7 as an example. To make the card easier to use, the command sequences are printed in the

General Printer Control

Name	Function	Char	Decimal	Hexadecimal
HORN	Sound printer horn	BEL	007	07H
CLEARBF	Clear printer buffer	CAN	024	18H
XFORMOUT	Disable paper-out switch	Esc 8	027 056	1BH 38H
FORMOUT	Enable paper-out switch	Esc 9	027 057	1BH 39H

Forms Control

Name	Function	Char	Decimal	Hexadecimal
FORMFEED	Form feed	FF	012	0CH
FORMLINE	Set forms to "N" lines	Esc C	027 067	1BH 43H

Vertical Line-Feed Control

Name	Function	Char	Decimal	Hexadecimal
LINEFEED	One line feed	LF	010	0AH
VT	One vertical tab	VT	011	0BH
SETVT	Set vertical tabs at "N1,N2,,,etc."	Esc B	027 066	1BH 42H
SPC6LPI	Set line feed at 6 LPI	Esc 2	027 050	1BH 32H
SPC8LPI	Set spaces at 1/8" (8 LPI)	Esc 0	027 048	1BH 30H
SPC10LPI	Set spaces at 7/72" (10 LPI)	Esc 1	027 049	1BH 31H
SPCN72	Set line feed "N"/72"	Esc A	027 065	1BH 41H

Horizontal Head Control

Name	Function	Char	Decimal	Hexadecimal
CR	Carriage return	CR	013	0DH
HT	One horizontal tab	HT	009	09H
SETHT	Set horizontal tabs at "N1,N2,,,etc."	Esc D	027 068	1BH 44H

Character-Font and Print-Control

Name	Function	Char	Decimal	Hexadecimal
COMP	Enable compressed characters (16.5 CPI)	SI	015	0FH
XCOMP	Disable compressed characters	DC2	018	12H
WIDE	Enable wide characters (5 CPI)	SO	014	0EH
XWIDE	Disable wide characters	DC4	020	14H
EMPHIZE	Enable emphasized characters	Esc E	027 069	1BH 45H
XEMPHIZE	Disable emphasized characters	Esc F	027 070	1BH 46H
DOUBLE	Enable double-strike characters	Esc G	027 071	1BH 47H
XDOUBLE	Disable double-strike characters	Esc H	027 072	1BH 48H

Table 7. Epson MX-80 printer command sequences; functional area order (including ASCII codes).

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right-hand columns, first as characters, then as decimal ASCII codes, and finally as hexadecimal ASCII codes.

The card for your own printer may be smaller or larger than table 7 and may have a different number of functional areas, depending on your printer's features. The codes used for your printer's programming language undoubtedly will be different. Even if your printer is another Epson model, some command-sequence codes will be different, and the number of features and functional areas will not be the same.

Earlier on, we promised to show you how to translate printer command sequences into control-code format. Remember that the control-code format is defined only for the ASCII control characters (those characters with ASCII codes 1 through 31) and is rarely used in IBM PC applications. The characters are available on your PC's keyboard, however. (They are used somewhat inconsistently by PC-DOS, Basic, and other PC systems and applications.)

Converting an ASCII code to its terminal control-code equivalent involves finding the letter whose position in the alphabet corresponds to the decimal ASCII value. For example, to convert ASCII 007 to a terminal control code, look for the seventh letter of the alphabet—G. The control-code equivalent of ASCII 007 is control-G.

Control Code	Character	ASCII Character Code
001	Control-A	065
002	Control-B	066
•	•	•
•	•	•
007	Control-G	071
008	Control-H	072
009	Control-I	073
010	Control-J	074
011	Control-K	076
012	Control-L	077
013	Control-M	078
•	•	•
•	•	•
027	Control-[	091

Table 8. ASCII control-code format.

An abbreviated control code table looks like table 8.

By now you probably recognize the uses of the more common control codes, control-G through control-M. We listed the escape character, ASCII 027, to demonstrate why the control-code format is not defined for the higher codes (032 and up) and why it can be confusing. The ASCII character set defines thirty-one control codes (1 through 31), yet the alphabet has only twenty-six letters. To make the upper few control codes work, you have to borrow characters from the ASCII character set that follows the alphabet. You may not find this part so easy to remember!

To prove to yourself that the PC's keyboard understands the control-code format, hold down the control key and hit the left bracket ([). Your PC will faithfully behave just as if you had pressed the escape key. Most other control codes will appear on the screen with a caret (∧) preceding the ASCII character used (∧L, for example). If you use control codes in PC-DOS or in Basic, you'll find that some of them (but not all) have their normal "action" effect. For example, line feed (∧J) and carriage return (∧M) operate as action codes and are not displayed on the screen. The BEL code (∧G), if issued in Basic, causes your speaker to beep. The form-feed control code (∧L) in DOS just displays ∧L; in the Basic editor, however, the form-feed control code clears the screen.

We listed the decimal ASCII codes in order to show that there's an alternative way to display, and sometimes input or use, the control-code format. If you hold down the alt key, type the decimal ASCII code on the numeric keypad (the numbers to the right of the enter key), then let up the alt key, you'll accomplish the same thing as you would if you entered the control code directly by means of the control key. You can prove this to yourself by typing alt-13 at the DOS A> prompt; alt-13 should have exactly the same effect as control-M.

Now that you have your printer's command sequences organized and tabulated, you might find it a worthwhile exercise to try printing your reference card in as small a format as your printer will allow. It'll be a chance for you to try using some of the print-compression features of your printer. If you get stuck, don't worry; you'll learn more about how to use these features in later installments of this column. ▲

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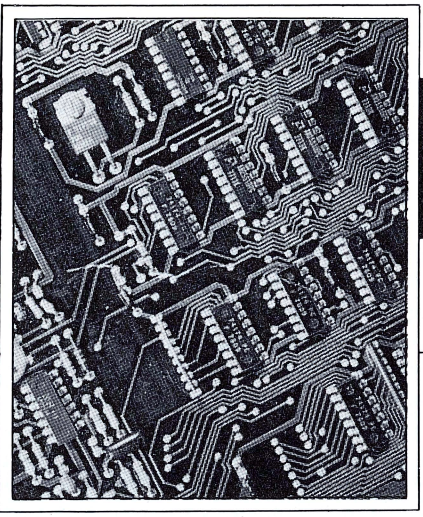

BOARDS AND BUSES

by Kevin Goldstein

Xenix, Graphics Boards, and Multiplexing

There's a rumor abroad that Microsoft is planning to introduce a new version of Xenix, the company's implementation of the Unix operating system that's so well liked by program developers. This version of Unix will supposedly run on a coprocessor board that the company will simultaneously introduce with the operating system. Now here's the good part: The coprocessor board will feature the Intel 80286, the super-fast, super-high-performance bigger brother of the 8086. The introduction is reportedly being delayed both by shortages of the 80286 and by Microsoft's uncertainty over how the move might be received by IBM.

In the meantime, everyone is wondering just when DOS 3.0 will appear. That next major release of DOS is expected to be a fully multitasking system; from early indications, a multitasking system will mesh quite well with Microsoft's recently announced Windows operating environment.

As long as we're mongering rumors, here's another: You may have noticed a shortage of graphics boards of late; almost everybody seems to be out of them. The reason appears to be the imminent announcement by Big Blue of a new, improved graphics card. Said card allegedly offers twice the resolution of the current card, meaning something on the order of 640 by 400 lines. No word yet as to the number of colors available at that higher resolution, but it's a good bet that it'll equal or better the specs of the PC*jr*. It's unseemly that Junior should have better graphics capabilities than Dad, and you can bet IBM will rectify that quickly, which means you'll be able to run all those nifty games written for Junior on Senior.

Designing a higher-performance graphics card is no big deal; the trick is finding a monitor—at a reasonable price—that can support that higher resolution. Until recently, such a monitor could easily set you back $1,800 or more. The situation is starting to change, however. At Comdex last November, Princeton Graphics was showing a monitor that sported 690-by-480 resolution in sixteen colors, with each color available in two intensities.

Those interesting specs were achieved without resorting to interlace. In other words, the Princeton Graphics screen is repainted entirely every sixtieth of a second; interlacing monitors repaint only *half* the screen (every other line) each sixtieth of a second (see "Boards and Buses," August 1983). Thus the PGS monitor is capable of a text display as fine as that of IBM's highly regarded monochrome monitor. It may even be better than IBM's, since the IBM monochrome screen offers only 350 lines of resolution versus Princeton Graphics's 480. And all this will set you back only $799.

Don't rush out to get one yet, though. They won't be in the stores for another several weeks, and that may be just when IBM introduces its new board. (Princeton Graphics will also be offering a display adapter of their own, capable of taking advantage of their monitor's high resolution.)

There are other reasons to expect action on the graphics front. First is the imminent ubiquity of window-oriented operating environments. All window operating environments require bit-mapped graphics. The only way to get some word-juggling types to abandon their monochrome displays is to dangle a display of equal or better quality before their eyes; simply pasting a windowing environment onto a display whose text characters are as poor as those produced by the current graphics board won't do it. That's why it's a good bet that, whatever windowing system IBM chooses to support, it will announce a new graphics board more or less at the same time it announces that support.

Finally, there's the little item from Tandy's Radio Shack division: a low-priced, MS-DOS, 80186-based computer featuring 640-by-400 color graphics and eight colors. Can Big Blue ignore that kind of competition?

MultiMate, MultiTool, Multiplan, Multi-Plex. Whoops—that's not right. Contrary to appearances, multiplex is not a new software package—it's a way of funneling multiple information sources through a single information channel. An information channel is simply a path through which information may be sent. Since our context here is computers, the channel is most likely a wire, and the information probably takes the form of bits and bytes. But an information channel could also be a hollow tube that a ship captain shouts through to tell the engine room to pour on more power.

There's a limit to the amount of information you can put through any channel. (If the captain, first officer, and a startled passenger all begin shouting through the tube at the same time to tell the engine room to do something before the ship hits that glacier off to starboard, the people in the engine room probably won't understand a thing—all they'll hear is some excited garble.) The information-carrying ability of a channel is called its *bandwidth*.

There is, of course, an obvious way that three people could use one tube to talk to someone at the other end. They could take turns. The use of the information channel would be divided in such a way that each person would have a time slot in which to communicate.

In computer terminology, dividing the use of an information channel according to time is called *time-division multiplexing*, and it's the key to understanding all the brouhaha about whether the 8088 is a sixteen-bit processor or an eight-bit processor.

Here we must digress. We'll come back to multiplexing and the 8088 in a moment.

A microprocessor is just a sliver of silicon, far too small to be manipulated easily by human hands. To make life easier for the people who have to solder all those silicon slivers onto circuit boards, the integrated circuit (chip) manufacturers mount those slivers into buglike packages with a row of metal legs (pins) sprouting from each side. Hence the moniker DIP, for *dual-in-line package*, a reference to the physical arrangement of the pins.

The pins serve two purposes: They provide a way of mechanically anchoring the DIP to a circuit board, and they provide electrical connection between the very small silicon chip and the relatively gigantic circuit board. The pins are connected by fine wires to different points on the surface of the silicon chip, and then the whole works—chip, wires, and one end of each pin—is protected by encasement in plastic or ceramic (ceramic is better at radiating heat from the chip; plastic is cheaper). The result is an integrated circuit.

One of the more difficult, hence expensive, aspects of the integrated-circuit manufacturing process is the soldering of those fine wires to the chip. We are talking very small dimensions, and, even though the process is mostly automated, the chance that gremlins will sneak in is great. Furthermore, those pins are one end of a little communications channel that the chip uses for talking to the external world—the other integrated circuits on the circuit board. The more pins you add, the larger the whole package gets, which in turn means the circuit board must grow; that makes your PC both bigger and more expensive.

To keep both the cost and size of circuit boards under control, chip manufacturers have come up with a number of clever ways to reduce the number of pins necessary for communication with the outside world. The primo method is time-division multiplexing; different parts of the chip communicate over the same pin at different times.

A microprocessor has a lot of information to send and receive. This includes various control signals in addition to your ordinary data. But the microprocessor can't just send data out blindly—it must indicate *where* the data is to be sent.

The PC has an address space of one megabyte, which is two to the twentieth power bytes. In order for the microprocessor to specify that many unique addresses, it requires twenty lines; these lines are collectively referred to as the address bus.

A processor with sixteen-bit registers (such as your PC's 8088 or the 8088's sibling chip, the 8086) deals with data sixteen bits at a time, so add to those twenty address lines another sixteen for data and you'll find that the 8086 and 8088 need thirty-six pins for address and data alone. Add to that total a couple of additional lines for power, several for timing and control signals, plus a few other lines you'd just as soon not know about, and you'll have a chip with well over fifty pins.

Separate pins for address, data, timing, control, power, and so on, is exactly the approach taken by such high-performance chips as Motorola's 68000 microprocessor. Because the 68000 can directly address sixteen megabytes (two to the twenty-fourth power bytes), it requires twenty-four lines for the address; another sixteen lines are eaten up by the data bus, and yet another twenty-four lines are required for miscellany. Count it up and you'll have a microprocessor with sixty-four pins sticking out of it.

That is one huge package. More than one disgruntled circuit board designer has called it a battleship. ("How large is it?" the audience asks. It's soooo large, it has a tendency to do nasty things like fall out of its socket when vibrated.) It's also expensive (a chip that large needs to be packaged in the more costly ceramic material), and it takes up a lot of space on the circuit board. Furthermore, each of those pins is communicating with something, so a circuit that large implies a lot of support chips on the printed circuit board.

The 8088 isn't as large as the 68000, partly because it needs four fewer address lines. Yet, instead of making the 8088 a sixty-pin package, Intel manages to cram the whole thing into a trim forty-pin bundle. It pulls that trick by time-division multiplexing those pins it does have.

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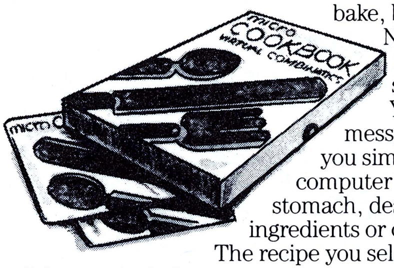

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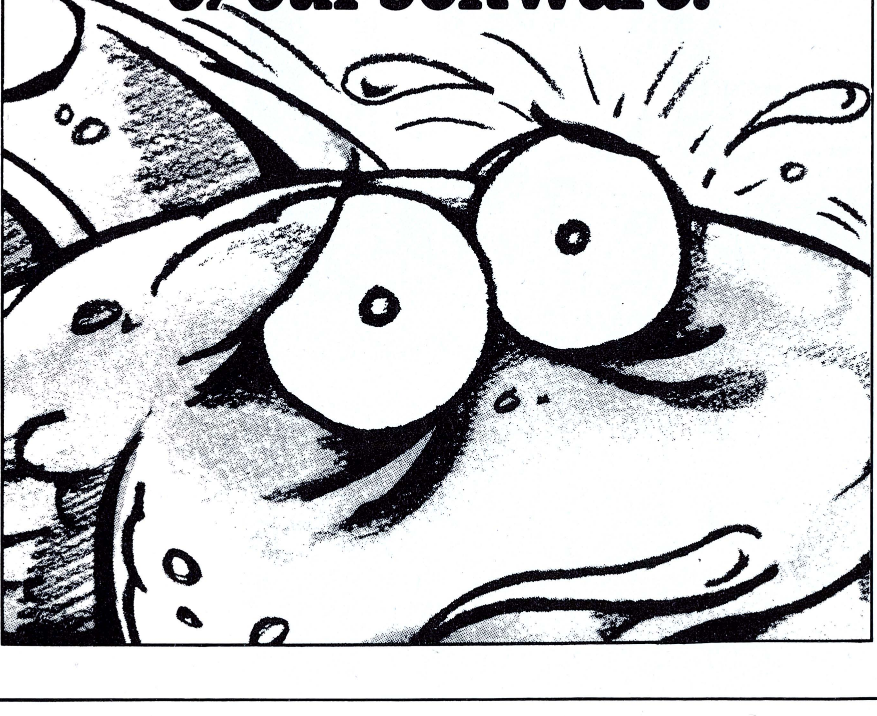

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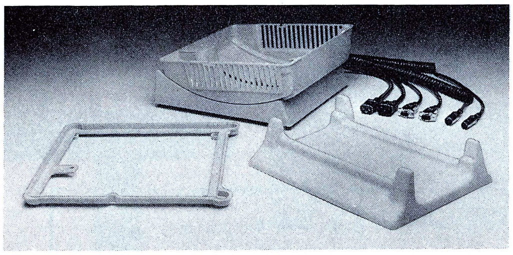

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most (lower) eight bits; after those bits are safely written to RAM, it sends the leftmost (upper) eight. The 68000, in contrast, just plops the whole word of data onto its sixteen-line data bus.

Now here's a surprise: The 8086, which, like the 68000, sends all sixteen bits at once, is also housed in a forty-pin package. The 8086 multiplexes all sixteen of its data pins with the lower sixteen lines of its address bus. When the 8086 needs to send a sixteen-bit word, it first sends out the address over twenty pins; then it sends out all sixteen bits of data over sixteen of those twenty pins. (During that second time slot, the other four address lines carry control signals.)

A complete data transfer in the 68000 takes only one machine cycle, with address and data all sent at once; the same transfer takes two cycles on the 8086 (address, followed by data on the same pins) and three on the 8088 (address followed by the lower byte of the data word followed by the upper byte of the data word). Both the 8086 and 8088 save quite a few pins by multiplexing the data bus on the same pins as the address bus.

Why doesn't the 8088 simply send out all sixteen data bits over the lower sixteen pins of the address bus? Because it uses the other eight pins for other signals. And what's the advantage of doing that? It saves chips; only half as many external chips are needed to support an eight-bit bus.

This may be one reason why IBM chose the 8088 over the 8086 for the PC. Another reason may be the fact that eight-bit microprocessors had been around awhile by the time the PC went on the drawing board; support chips compatible with eight-bit processors were plentiful and cheap, while sixteen-bit support chips were relatively rare and expensive. The fact that the 8088 can be configured into a minimum system of 16K, whereas the 8086 would have required at least 32K (see "Boards and Buses," September 1983, for an explanation of why this is so), may also help explain IBM's choice.

Since the 8088 deals with sixteen bits at a time internally (on the chip itself) but deals with the outside world eight bits at a time, the question arises: Is the PC an eight-bit machine or a sixteen-bitter? The answer, of course, is that it's a sixteen-bit machine with an eight-bit bus.

But that answer is long and doesn't fit neatly into ad copy. The trend seems to be toward defining a microprocessor in terms of the number of bits it handles internally; by that criterion, the 8088 is a sixteen-bit processor just like the 8086. In any case, the next time someone belittles your PC by saying it uses an eight-bit processor, you can smile wisely as you launch into a discourse on the advantages of multiplexing. ▲

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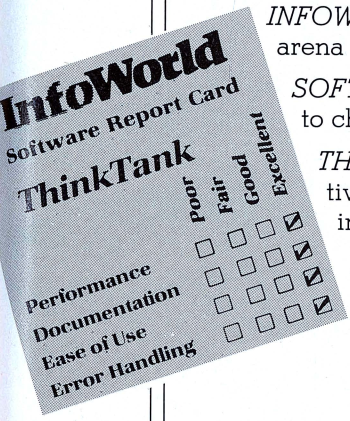

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2. Fill out the accompanying postage-paid ballot with up to ten choices ranked in order from your number 1 favorite to your number 10 favorite. If your ballot card is missing, write down your name, address, choices, and comments and send them anyway. Be neat. This is a weighted ballot; we'll give ten times as many points to your number 1 favorite as to your number 10.

3. Use the blank space for any comments, complimentary or derogatory, that you wish to make about the products on your list (or products you left off your list). This is an opportunity to talk back to the software industry; we'll print some of these comments in our April "Crosstalk" column.

4. Products must have been released between October 1, 1982, and December 31, 1983. The accompanying list of programs is meant to jog your memory; it's not exhaustive. Feel free to vote for items that don't appear there.

5. Send your completed ballot to Softalk for the IBM Personal Computer, Box 7040, North Hollywood, CA 91605.

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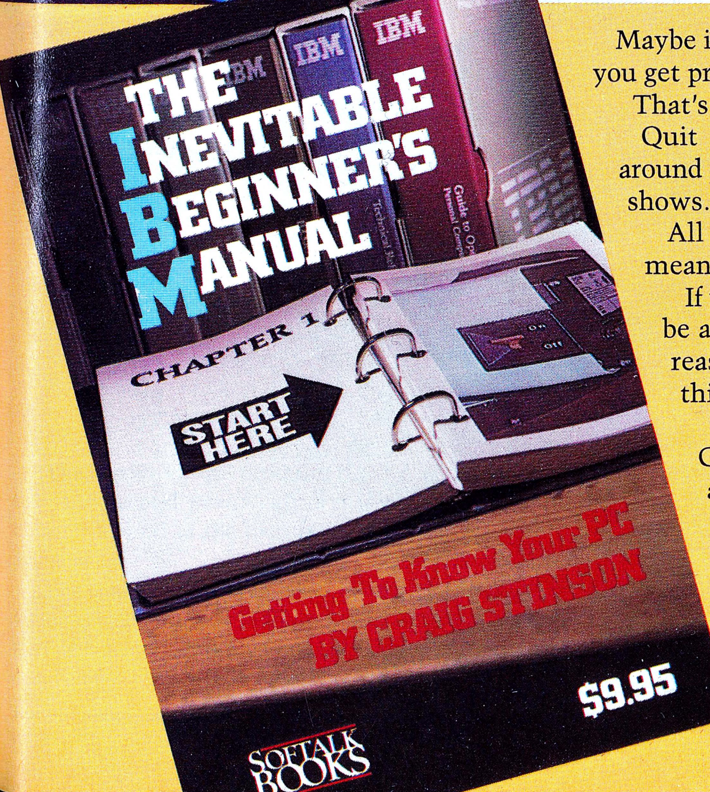

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- Pig Pen
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- Star Trek
- SuperCalc
- SuperCalc2
- Suspended
- Temple of Apshai
- Time Manager
- TK!Solver
- Total Information Management
- Transend II
- Typing Tutor
- UCSD Pascal
- Versa Form
- VideoGraph 88
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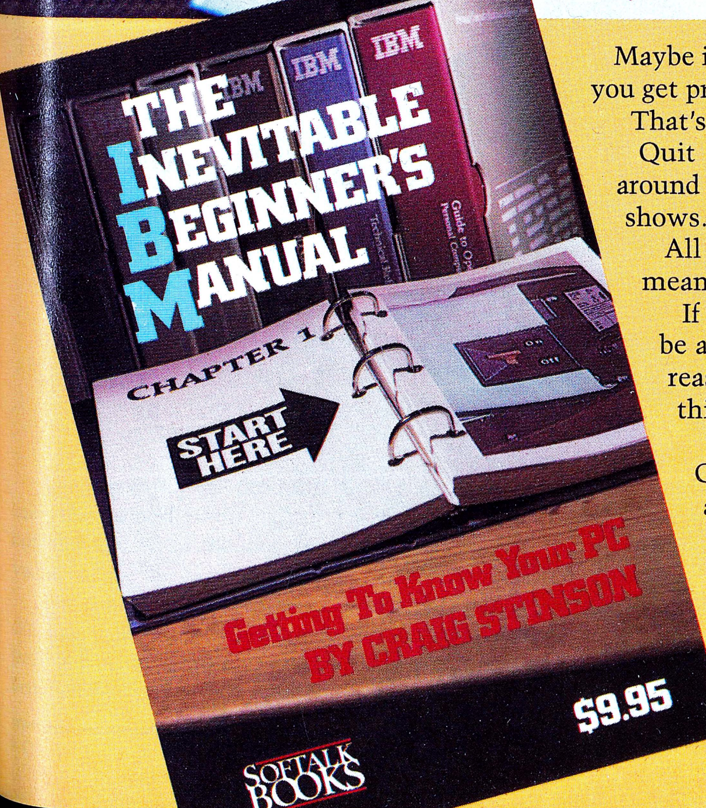
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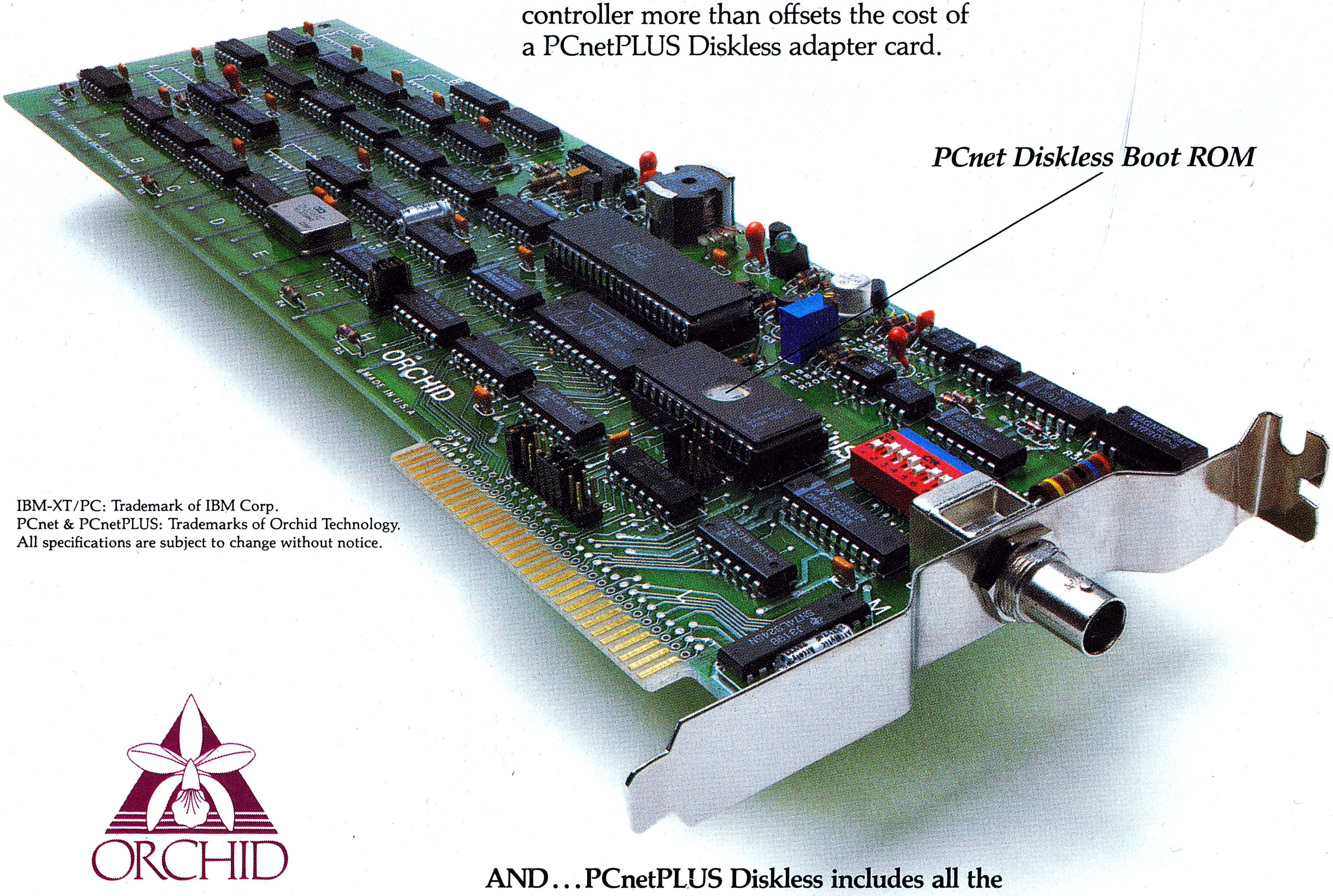

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THE C SPOT

by Rex Jaeschke

While Loops and Other Matters

Like most traditional programming languages, C has several different methods of implementing conditional and unconditional branching and looping. This month we'll look at several of these methods and comment on their use.

The *while* Construct. A while loop consists of a condition and a body. While the condition is true (nonzero), the body is performed. Let's look at a simple example.

```
/*--while.c The while construct--*/
main ()
{
    int counter;

    printf ("i\ti*i\n");          /* print headers */
    printf ("----------\n");
    counter = 1;                  /* initialize loop control variable */
    while (counter <= 10) {       /* test loop control variable */
      printf ("%d\t%d\n", counter, counter * counter);
      ++counter;                  /* increment loop control variable */
    }
    printf ("----------\n");      /* print footer */
    return;
}
```

The program produces this output:

```
i          i*i
---------------
1          1
2          4
3          9
4          16
5          25
6          36
7          49
8          64
9          81
10         100
---------------
```

The first *printf* call produces the headings *i* and *i*i* separated by a tab; the second *printf* call underlines them. The integer variable *counter* is used as the loop control variable and is initialized with a value of 1.

The condition in parentheses, *(counter <= 10)*, is tested. If the condition is true, the body of the loop (the statements enclosed by the inner pair of braces) is executed and the condition is tested again. When the condition becomes false (condition = 0)—in this case when counter is greater than ten—the loop ends and execution continues at the statement following the end of the loop. If no statement follows the loop, the function is finished. If the condition is initially false, the loop is never executed. This means that the program will behave rationally, regardless of the initial value of the control condition.

The body of the loop may be a single or compound statement.

A compound statement (also called a block) is a group of declarations, statements, or both, delimited by { and } that is treated syntactically as a single statement. Each function must contain at least one compound statement. A compound statement may contain other compound statements.

One common programming error is the omission of the braces from a compound statement. Consider the following example:

```
function ()
{
      while (condition)
            statement 1
            statement 2
      statement 3
}
```

Judging by the indented format, it appears that the programmer intends both *statement 1* and *statement 2* to be included in the loop body. However, as no braces exist to define a compound statement, the body is considered to be only *statement 1*. *Statement 2* (like *statement 3*) is executed regardless of the condition evaluation—and then only after the loop has been terminated or skipped.

Be careful in situations when your loop body originally has only one statement and you add other statements to it later; it's particularly easy to forget the braces under these circumstances. Beware in general of hasty code modifications and enhancements; they're difficult to debug, particularly in cases such as the example just shown, where the code "lines up" and looks correct at a passing glance. Cobol programmers no doubt have experienced this problem when they misplaced end-of-sentence periods.

To force the loop body to include both statements, the code should read

```
function ()
{
   while (condition) {
         statement 1
         statement 2
   }
   statement 3
}
```

The condition expression may include such obvious operators as >, >=, <, and <= as well as two less obvious ones, *!=* and ==. Note the unusual form *!=*, which means "not equal to."

Equality is tested using ==, which is different from the assignment operator, =. Some programmers find this distinction useful because equality testing and assignment are quite different operations. A similar distinction is made in Pascal; in that language *:=* is the assignment operator and = tests for equality. This approach to language definition reduces ambiguity and makes the writing of syntax checkers considerably easier.

A special condition to note is *while (1)*. As *1* is a nonzero value and therefore means "true," the *while (1)* loop is infinite and must be terminated via the break or return statements or by some other mechanism.

In our *while.c* example, each time the body of the loop is executed, the values of *counter* and *counter* squared are printed on the same line separated by a tab. Notice that expressions, such as *counter * counter*, may be used as function arguments. In fact, C allows a compound expression, a variable, or a constant to appear in assignment statements and function calls, provided they reduce to values of the expected data type.

Unary Operators. The unary increment operator ++ is a common and succinct notation used throughout C. *++counter;* and *counter++;* are both equivalent to *counter = counter + 1;*. The ++ increment operator may be used as either a variable prefix or a variable suffix. In this example, the increment operator has the same effect, whether it's put before or after the variable name.

This is not always the case, however. If *a* and *b* are integers, then *a = b++;* and *a = ++b;* give different values to *a*. In the first case, *a* is set to *b* and then *b* is incremented by 1. In the second, *b* is incremented, and then its new value is assigned to *a*.

++i may not be written as *+ + i;*. However, *++ i* and *i ++* are legal. The unary operator includes both + symbols.

There is an equivalent unary decrement operator, −−.

It is tempting to consider ++ and −− as operators that increment and decrement by 1. Although this is the case when these operators are applied to integer variables, ++ and −− have a much more powerful role when used with pointers—as you'll see in future installments.

Return. The *return* statement causes control to return to the calling function. A return from function *main* terminates a program. The *return* statement has the same effect as the last brace in a function. In the example given above, the *return;* is superfluous.

Note the way that the brace pairs line up to make the logic flow more obvious. This format, the one recommended by Kernighan and Ritchie, greatly improves program readability.

Incrementing and Decrementing Variables. Last month you learned that C allows the programmer to get quite close to the host machine architecture and instruction set, particularly in the generation of efficient machine code. To see an example of this intimacy, let's look at several ways to increment a variable and the 8086/8088 code generated by one commercial C compiler for each example. The following discussion applies equally to variable decrementing.

```
main ()
{
                  /* 0000 55          PUSH BP */
                  /* 0001 8BEC        MOV BP,SP */
     int i;
                  /* 0003 83EC02      SUB SP,2 */
     ++i;
                  /* 0006 FF46FE      INC WORD [BP-2]
                                      */
     i++;
                  /* 0009 FF46FE      INC WORD [BP-2]
                                      */
     i = i + 1;
                  /* 000C 8B46FE      MOV AX,WORD
                                      [BP-2] */
                  /* 000F 050100      ADD AX,1 */
                  /* 0012 8946FE      MOV WORD [BP-
                                      2],AX */
     i += 1;
                  /* 0015 8346FE01    ADD WORD [BP-
}                                     2],1 */
                  /* 0019 8BE5        MOV SP,BP */
                  /* 001B 5D          POP BP */
                  /* 001C C3          RET */
```

++i and *i++* generate the same three bytes of code and directly use the increment instruction. *i = i + 1;*, however, generates nine bytes of code, involving two MOVs and one ADD. Programmers concerned with speed will appreciate the obvious advantage of the ++ operator. In fact, you can replace *i = i + 2;* and *i = i + 3;* with two or three occurrences of *++i;* and still come out ahead in terms of speed.

Bit-and-byte enthusiasts working on an 8088 system know that that processor has only a four-byte instruction object code queue, compared with the 8086's six bytes. This means that fetching a six-byte instruction sequence requires eight extra clock cycles for the fifth and sixth bytes. Also, the 8088's eight-bit bus requires two bus cycles to fetch sixteen bits of data.

Moving along in our list of ways to increment a variable, we come to the expression *i += 1;*. This is an abbreviated form of *i = i + 1;*, except it generates only four bytes of machine code instead of nine. *i += n* can be used for any value of *n*. For cases where *n* is greater than

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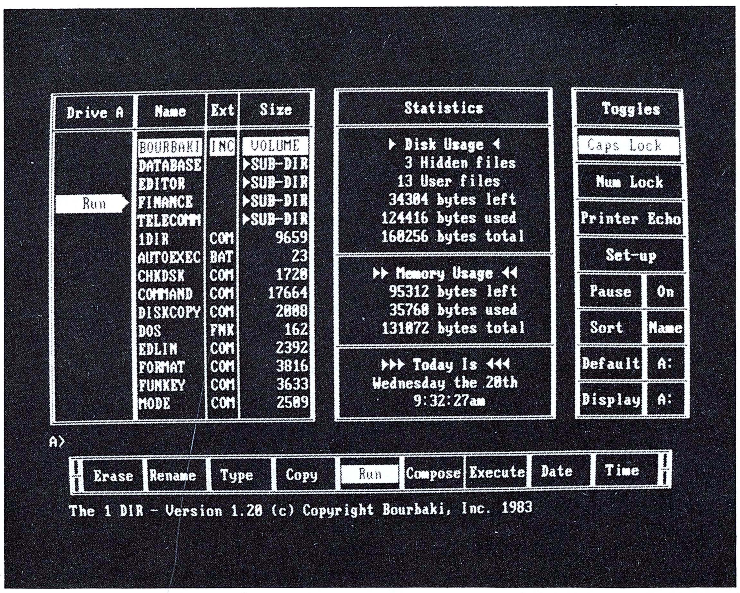

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        | EDITOR   |     | ▸SUB-DIR |   13 User files        | Printer Echo
  Run ▸ | FINANCE  |     | ▸SUB-DIR |   34304 bytes left     | Set-up
        | TELECOMM |     | ▸SUB-DIR |   124416 bytes used    | Pause   | On
        | 1DIR     | COM |     9659 |   160256 bytes total   | Sort    | Name
        | AUTOEXEC | BAT |       23 |  ▸▸ Memory Usage ◂◂    | Default | A:
        | CHKDSK   | COM |     1720 |   95312 bytes left     | Display | A:
        | COMMAND  | COM |    17664 |   35760 bytes used     |
        | DISKCOPY | COM |     2000 |   131072 bytes total   |
        | DOS      | FNK |      162 |  ▸▸▸ Today Is ◂◂◂      |
        | EDLIN    | COM |     2392 |  Wednesday the 20th    |
        | FORMAT   | COM |     3816 |   9:32:27am            |
        | FUNKEY   | COM |     3633 |
        | MODE     | COM |     2509 |
A>
 Erase | Rename | Type | Copy | Run | Compose | Execute | Date | Time
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```

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1, this form is more efficient than *++i;* repeated *n* times.

Other compound assignment operators include −=, *=, and /=.

We'll see another advantage of using ++ and −− later, when we deal with structures. When using structures it is useful to refer to a "variable" by its full structure pathname, such as *employee.special.sickdays.* In this case, incrementing the number of sick days that an employee has used requires either

```
employee.special.sickdays = employee.special.sickdays + 1;
```

or

```
++employee.special.sickdays;
```

or

```
employee.special.sickdays++;
```

or

```
employee.special.sickdays += 1;
```

Which would you rather type or read? The first alternative is the hardest to type, is most error prone, and generates the most code. Choosing one of the other three is largely a matter of personal preference.

Increment and decrement operators may be used in statements such as

```
printf ("%d %d %d\n", a++, ++b, c--);.
```

Using this knowledge, you might be tempted to use something like

```
printf ("%d\t%d\n", counter, counter * counter++);
```

in the *while.c* example given previously and thereby eliminate the need for a separate increment statement. Although this may produce the correct result on one machine, it may not on others. C, like most other languages, gives no guarantee about the evaluation order of multiple arguments in a function call. The arguments might be evaluated as *counter, counter++ * counter* or as *counter++, counter * counter.* The two are quite different.

Symbolic Constants and Character I/O. Let's look at a simple yet powerful utility that uses the construct just discussed.

```
/* --- copy1.c Copying input to output, symbolic constants --- */
#define EOF -1
main ()
{
    int c;
    while ((c = getchar ()) != EOF)
          putchar (c);
}
```

getchar and *putchar* are functions provided by the compiler vendor in its C runtime library. They are *not* part of the C language. *getchar* gets a character from standard input and *putchar* writes a character to standard output.

This program copies characters from standard input to standard output until end-of-file (EOF) is reached. Unfortunately, several different conventions are used to represent the EOF marker (−1 being one of them), so if you want your routine to be portable, don't test EOF against a specific value. In this example, we compare *c* with *EOF,* a symbolic constant that we define at the start of the program. Symbolic constants are particularly useful when they're referenced several times in a source file. They also help document obscure constant values.

Symbolic constants are handled by the C preprocessor, which replaces each of their references in the source file with the appropriate defined value. Thus the *EOF* in the *while* statement is replaced with the character string −1 before the input line is passed to the compiler.

Other examples of symbolic constants are *#define PI 3.1415926* and *#define LINEFEED 10*. Such constants can be used to replace almost any text string in a C program. Symbolic constants have the same naming conventions as do variables, but they're conventionally written in uppercase letters.

The character that's read is stored in variable *c,* which is defined as an integer rather than as type char. The reason for this type definition is that all character bit patterns may be valid characters in a character set, so some mechanism is needed to detect a noncharacter value, such as EOF. As each character is read, it is compared with *EOF* and if *c != EOF,* the character is sent to standard output; the process continues until *EOF* is found.

Notice that the while condition expression contains an assignment. This is a valid practice in C. Such expressions are evaluated left to right according to operator precedence and, as *!=* has higher precedence than =, the parentheses around *c = getchar()* are mandatory; without them, the expression would be evaluated as *(c = (getchar () != EOF)),* where *c* would always be set to 0 or 1 (false or true) instead of to the value of the input character.

This may seem a trivial routine, but Unix and MS-DOS/PC-DOS 2.0 systems allow redirection of standard input and standard output at the system level. If such redirection is done, then *copy1.c* becomes an amazingly simple general-purpose device-independent file-copy utility.

One caution: the version of *getchar* that you use may be sensitive to certain characters other than EOF. Control-C on input may be interpreted as an abort signal. Therefore, copying a binary file that contains bytes with the control-C bit pattern may cause the copy to terminate prematurely. *printf* can achieve the same result as *putchar;* use *printf ("%c",c);* instead of *putchar (c);*.

We've seen an example of the use of symbolic constants. Although they remove dependencies from the source code statements above, the dependency still exists in the source code file in the *#define* directive itself. If a program has several source code modules that each contain references to *EOF,* each file must be changed if the program is to be ported to a system where the EOF marker has a representation other than −1. To avoid this problem, you can use the *#include* preprocessor directive, as shown in the following example:

```
/* --- copy1.c symbolic constant EOF defined in external header file --- */
#include "DEF.H"
main ()
{
    int c;
    while ((c = getchar ()) != EOF)
          putchar (c);
}
```

*#define*s occurring in multiple source code files in a program can be grouped together in a single file—such as DEF.H. A file of this kind is referred to as a header file and usually has a file type of H. Many compiler kits include header files such as STDIO.H, which contains common standard I/O definitions. Header files may contain any valid C source code statement or definition. Their contents are "included" into other source code files at compile time. As far as the compiler is concerned, the contents of the include file are part of the input source file.

Moving common symbolic definitions to a header file reduces the need to modify source files when programs are ported to different environments. Any changes required need be made only to the header files, with these changes being implemented when the source files are recompiled.

We'll introduce other preprocessor directives in future installments of this column. ▲

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Date 5106.2: *We emerged from hyperspace surrounded by four Krellan destroyers. GENERAL QUARTERS! We immediately engaged battle and fired off five torpedoes.*

Date 5106.3: *We destroyed two Krellan vessels and disabled a third, but a Zaldron warship arrived. We are laying mines since their invisibility screen makes our sensors useless.*

Date 5106.6: *Sensors indicate a large explosion. The Zaldron has struck a mine! Our tractor beam has the disabled Krellan ship in tow and our space marines are being transported aboard to effect capture.*

Date 5107.0: *Our boarding party was repulsed with heavy casualties. INTRUDER ALERT! The Krellans retaliated by beaming a sabateur aboard. An explosion on Deck 7 damaged our primary life support system. Have initiated a search and put Deck 7 on max security.*

Date 5107.6: *Krellan vessel finally captured by the marines and prisoners were taken. Received top priority orders to rescue Starbase 3 which is under attack by a Krellan fleet. Crew at battle stations--engaging hyperdrive.*

Date 5107.9: *COLLISION! Course intercepted by Krellan. POINT BLANK HIT! Have lost shield 1 and suffered massive damage and casualties. Engineering reports our backup life support system is failing. Cannot survive another attack or reach starbase! We must escape ... but HOW?!*

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BEHIND THE SCENES...

THE MAKING OF A TOOLBOX PROGRAM

BY JOHN SOCHA

A number of readers have reported problems using Scrnsave, the utility presented in December under this banner, in conjunction with Hayes Microcomputer Products's Smartcom II. Readers noticed that exactly three minutes after Smartcom started running, their screens went out and never came back.

Unfortunately, Smartcom bypasses the ROM BIOS keyboard routines, so there's no way Scrnsave can work with it. The solution is to disable Scrnsave before you run Smartcom. Scrnsave, as presented in December, isn't disable-able, so for now, at least, you'll need to reboot before running Smartcom II.

Backstage Tour. All the articles in this series have included a Basic program that builds a machine-language program. The present article, no exception, creates a .com file utility by means of a Basic program; but our focus this time will be on the Basic program itself—how the right numbers get into the program's *data* statements and how the program checks to make sure you don't enter *data* statements incorrectly.

To assist us in our work, we'll create another Basic program, called Makedata.bas. This program converts a .com file into a list of Basic *data* statements. Once created, this list can be fed to our second program, Writecom.bas, which does the building of the .com file.

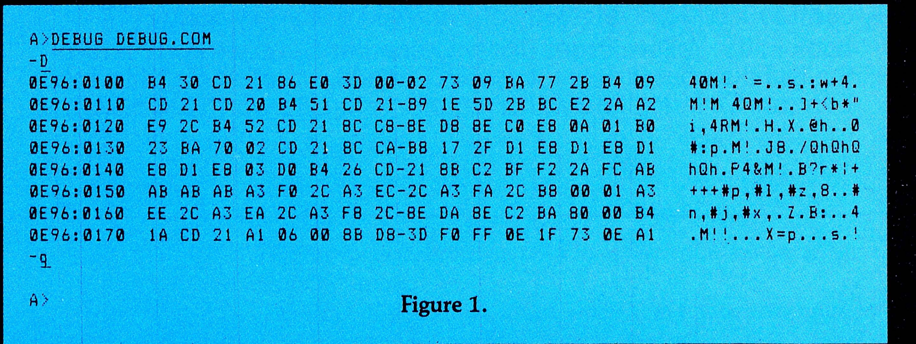
From now on, all programs in this series will be built from the same Basic program—Writecom.bas. Only the *data* statements will change. So you can type in Writecom.bas just once and then change the data for each new article.

Let's start by taking a look inside a .com file. To do this, we'll use a program on your DOS disk called Debug.com. Debug offers a variety of services, including the ability to examine files byte by byte. For demonstration purposes, we'll use Debug to look at the first part of itself—that is, we'll examine the file Debug.com by means of Debug.com.

Start by inserting your DOS disk (or a copy of it) in drive A and typing *debug debug.com* (in caps or lowercase—it doesn't matter). In response to Debug's hyphen prompt, type *d* (for dump) and hit enter. Debug will respond with a display that may or may not look exactly like figure 1.

Why might it not look like figure 1? Because Debug has evolved from its first appearance in DOS 1.0 to the current DOS 2.0 version. Figure 1 shows a dump of the first part of the DOS 2.0 Debug, so if you're using a version of DOS before 2.0, you'll see a different dump. And even if you are working in DOS 2.0, the numbers to the left of the colons in figure 1 may differ from the numbers to the left of the colons in your display. Those numbers indicate the location of the memory segment in which Debug is reading, and that location depends on the amount of memory you have in your machine.

A dump, incidentally, is just a display of the contents of a file. In response to your *d*



```
A>DEBUG DEBUG.COM
-D
0E96:0100  B4 30 CD 21 86 E0 3D 00-02 73 09 BA 77 2B B4 09   40M!.`=..s.:w+4.
0E96:0110  CD 21 CD 20 B4 51 CD 21-89 1E 5D 2B BC E2 2A A2   M!M 4QM!..]+<b*"
0E96:0120  E9 2C B4 52 CD 21 8C C8-8E D8 8E C0 E8 0A 01 B0   i,4RM!.H.X.@h..0
0E96:0130  23 BA 70 02 CD 21 8C CA-B8 17 2F D1 E8 D1 E8 D1   #:p.M!.J8./QhQhQ
0E96:0140  E8 D1 E8 03 D0 B4 26 CD-21 8B C2 BF F2 2A FC AB   hQh.P4&M!.B?r*|+
0E96:0150  AB AB AB A3 F0 2C A3 EC-2C A3 FA 2C B8 00 01 A3   +++#p,#l,#z,8..#
0E96:0160  EE 2C A3 EA 2C A3 F8 2C-8E DA 8E C2 BA 80 00 B4   n,#j,#x,.Z.B:..4
0E96:0170  1A CD 21 A1 06 00 8B D8-3D F0 FF 0E 1F 73 0E A1   .M!!...X=p...s.!
-q

A>
```

Figure 1.

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command, Debug has shown you, in hexadecimal numbers and their ASCII equivalents, the first 128 bytes of the file Debug.com.

To convert this dump into Basic *data* statements we could translate each number from hexadecimal into decimal, but that wouldn't be much fun. Even if we wrote a Basic program to do this conversion, we'd still have a lot of work to do. Fortunately, there are better ways.

Supporting Actor. Debug is designed specifically to read files (as well as to do a great many other useful things), but Basic, with just a little bit of programming, can be made to do the job just as well. In fact, it can be made to do more, as you'll soon see.

Here's a simple Basic program that reads and displays the beginning of Debug.com:

```
100 OPEN "debug.com" AS #1 LEN=1
110 FIELD #1,1 AS BYTE.$
120 FOR A.% = 1 TO 8
130    FOR B.% = 1 TO 16
140       GET #1
150       PRINT USING "\  \";HEX$(ASC(BYTE.$));
160    NEXT B.%
170    PRINT
180 NEXT A.%
190 END
```

The output of this program should look just like what you got from Debug, except that single-digit hex numbers will appear without the leading zero and you won't see the ASCII representation to the right of the hex numbers. So now we know that Basic can read and display the same information Debug can. Why should we print the numbers in hex? No reason; we did it here only to verify that Basic can give us the same numbers we found with Debug.

To change Basic's display to decimal notation, change line 150 to read:

```
150 PRINT USING "#####";ASC(BYTE.$);
```

Now we're getting closer to Makedata.bas, our program that reads a .com file and creates a list of *data* statements for Writecom.bas.

A Star Is Born. Before we look at the listing for Makedata.bas, let's examine its output. Figure 2 shows some of the output from Makedata for Debug.com. The output for Debug.com is much larger than what's shown in figure 2, but we don't need to see all of it. For the moment what interests us is the way in which the *data* statements in figure 2 are grouped.

The first group of *data* statements starts at line 1010. These numbers are nothing more than the machine code for Debug.com. Each number in this section represents one byte of machine code. The number of data lines appearing in this group depends on the length of your .com file. A .com program with only eight bytes would use just one line of data, while a program 300 bytes long would use (300 + 7) mod 8, or thirty-eight, lines of data, with the last line containing only four numbers. (The first thirty-seven lines will be full, and since each full line has eight numbers these first thirty-seven account for 296 (37*8) bytes of data; the remaining four bytes will appear in the thirty-eighth line.)

```
1010 DATA     180,     48,     205,     33,     134,     224,     61,      0
1020 DATA     2,       115,    9,       186,    119,     43,      180,     9
1030 DATA     205,     33,     205,     32,     180,     81,      205,     33
1040 DATA     137,     30,     93,      43,     188,     226,     42,      162
1050 DATA     233,     44,     180,     82,     205,     33,      140,     200
1060 DATA     142,     216,    142,     192,    232,     10,      1,       176
1070 DATA     35,      186,    112,     2,      205,     33,      140,     202
                               •
                               •
                               •
10000 '
10010 DATA    51,      35,     8,       55,     139,     75,      65,      81
10020 DATA    93,      88,     155,     67,     208,     150,     2,       255
10030 DATA    180,     239,    -106,    113,    89,      240,     90,      40
                               •
                               •
                               •
1000 DATA     11023,   691,    "debug.com"
```

Figure 2.

The next group, starting at line 10010, contains error-checking information. Each of these numbers is a *checksum* for one line in the group starting at line 1010.

A checksum is a number used to validate the data in one line. In this program, the checksum for each line is the *exclusive or (XOR)* of all the numbers in that line. (If you're not familiar with the concept of exclusive or, you might enjoy reading the IBM Basic manual, pages 3-25 to 3-28; there you'll find an explanation of the various logical operators available in IBM Basic—including *XOR*.)

For example, the checksum for line 1010 is

```
180 XOR 48 XOR 205 XOR 33 XOR 134 XOR 224 XOR 61 XOR 0
= 51
```

The result of all these XORs, 51, appears as the first number in line 10010. Writecom.bas will use the values in the *data* statements starting at line 10010 to check for errors in your list of *data* statements starting at 1010.

Finally we have the last data group, which is the single line 1000. The two numbers and one string in this line will tell Writecom.bas what to expect in the data starting at line 1010.

The first number in line 1000, 11023, is the number of data items in the first group, the group that starts at line 1010; the second number is a checksum for *all* the data, line 1000 excepted. Writecom.bas will use this last number to check the second group of data; but this works correctly only when all the lines in the first group (the one starting at line 1010) are correct. Finally, the string ("debug.com") is the name of the .com file Writecom.bas will create.

Filling the Silence. Some programs, such as Kbd_fix.com ("Socha's Toolbox," November 1983), have large areas of zeros. Rather than filling line after line with zeros, Makedata uses two numbers to represent an entire block of zeros. Wherever you see a −1 in the data, the following number tells Writecom how many zeros to write in one block. So if you have a program that's 700 bytes long, with one block of 200 zeros, the *data* statements at 1010 will have only 502 numbers rather than 700.

You can examine the details of Makedata.bas in figure 3.

The Lead Role. Writecom.bas, shown in figure 4, is the program you'll use from now on to generate all the .com files presented in this series. You can try it out in a moment—on the data for Cls.com, a short program that clears the screen. But first, let's take a quick look at Writecom.

Writecom.bas isn't as easy to read as Makedata.com, because it's optimized to be short and fast, not elegant. There's one new piece added here. Writecom.bas reads *data* statements as a read number. If you happen to leave out a comma when you're entering data, Writecom will ignore the intervening spaces; that is, it will read 128 65 as 12865. The result of such an error may be a number too large to be a one-byte integer. If Writecom sees a number larger than 255 (the maximum for one byte), it knows a comma may be missing.

Encore. Figure 5 contains the data for a short program, called Cls.com, that clears the screen from DOS. This should prove handy to those of you who are working in DOS 1.1 (DOS 2.0 includes an internal command called *cls*). To build Cls.com, enter the statements shown in figure 5 into the file Cls.bas, then, from Basic, type the following

```
LOAD "CLS"
MERGE "WRITECOM"
SAVE "CLS.BAS",A
RUN
```

You'll now have Cls.com on your disk. Give it a try by typing *cls* after the DOS prompt.

For reference, the assembly listing of Cls.com is shown in figure 6. ➤

```
100 GOSUB 1000                              'Initialize variables, etc.
110 GOSUB 2000                              'Get name of input and output files
120 GOSUB 3000                              'Open files for input and output
130 CHECK.SUM.% = 0
140 PRINT "Writing";
150 GOSUB 4000                              'Generate the data for program
160 GOSUB 5000                              'Write data for checksum
170 NUM.DATA.% = 0 : DATA.BASE.% = 1000
180 NUM.% = LENGTH.%                        'Output number of bytes
190 GOSUB 6000                              'Write the number of bytes
200 NUM.% = CHECK.SUM.%                     'Write the checksum
210 GOSUB 6000
220 PRINT#2, ",";CHR$(9);CHR$(34);COM.FILE.$;CHR$(34)
230 END
1000 '---------------------------------------------------------------------------------------'
1010 ' This subroutine is just for initializing variables, etc.                              '
1020 '---------------------------------------------------------------------------------------'
1030 TRUE.% = -1                            'Set the two Boolean values
1040 FALSE.% = 0
1050 RETURN
2000 '---------------------------------------------------------------------------------------'
2010 ' This subroutine gets the names for the input and output files.                        '
2020 '              COM.FILE.$                  Name of the '.com' file to read              '
2030 '              DATA.FILE.$                 Where Makedata writes the data               '
2040 '---------------------------------------------------------------------------------------'
2050 INPUT "Name of com file (without extension)";COM.FILE.$
2060 DATA.FILE.$ = COM.FILE.$ + ".bas"      'Build name for Basic data statements
2070 COM.FILE.$ = COM.FILE.$ + ".com"       'Build name for '.com' file
2080 RETURN
3000 '---------------------------------------------------------------------------------------'
3010 ' This subroutine opens the two files and sets some variables                           '
3020 '              LENGTH.%                    The number of bytes in the '.com' file       '
3030 '              #1                          file number of COM.FILE.$                    '
3040 '              #2                          file number of DATA.FILE.$                   '
3050 '---------------------------------------------------------------------------------------'
3060 OPEN COM.FILE.$ AS #1 LEN=1
3070 LENGTH.% = LOF(1)                      'Get number of bytes in '.com' file
3080 PRINT "Length = ";LENGTH.%
3090 DIM CHECK.%(LENGTH.%)                  'Reserve room for checksums
3100 OPEN DATA.FILE.$ FOR OUTPUT AS #2
3110 FIELD #1,1 AS BYTE.$
3120 RETURN
4000 '---------------------------------------------------------------------------------------'
4010 ' This subroutine writes the data statements for each byte in the                       '
4020 ' '.com' file.                                                                          '
4030 '---------------------------------------------------------------------------------------'
4040 NUM.BYTES.% = 0 : NUM.DATA.% = 0 : DO.CHECK.% = TRUE.%
4050 DATA.BASE.% = 1010                     'Start data statements at 1010
4060 WHILE NUM.BYTES.% < LENGTH.%
4070     GET #1                             'Read the next byte
4080     NUM.BYTES.% = NUM.BYTES.% + 1
4090     ZERO.COUNT.% = 0
4100     WHILE (ASC(BYTE.$) = 0) AND (NUM.BYTES.% < LENGTH.%)
4110         ZERO.COUNT.% = ZERO.COUNT.% + 1
4120         GET #1
4130         NUM.BYTES.% = NUM.BYTES.% + 1
4140     WEND
4150     IF ZERO.COUNT.% = 1 THEN NUM.% = 0 : GOSUB 6000
4160     IF ZERO.COUNT.% > 1 THEN IF.COND.%=TRUE.% ELSE IF.COND.%=FALSE.%
4170         WHILE IF.COND.%
4180             NUM.% = -1                 'Signal "repeat count for 0s follows"
4190             GOSUB 6000
4200             NUM.% = ZERO.COUNT.%       'Write the repeat count
4210             GOSUB 6000
4220             IF.COND.% = FALSE.%
4230         WEND
4240     NUM.% = ASC(BYTE.$)                'Now write the next byte
4250     GOSUB 6000
4260 WEND
4270 RETURN
5000 '---------------------------------------------------------------------------------------'
5010 ' This subroutine writes the checksum data for each line of data                        '
5020 ' statements.                                                                           '
5030 '---------------------------------------------------------------------------------------'
5040 PRINT#2, "" : PRINT#2, 10000"'";       'Leave a blank line at the start
5050 DO.CHECK.% = FALSE.% : CHECK.SUM.% = 0
5060 LENGTH.% = NUM.DATA.%                  'Number of data items written
5070 NUM.CHECK.% = (NUM.DATA.% + 7) \ 8
5080 NUM.DATA.% = 0 : DATA.BASE.% = 10010
5090 FOR I.% = 1 TO NUM.CHECK.%
5100     NUM.% = CHECK.%(I.%)
5110     CHECK.SUM.% = CHECK.SUM.% XOR NUM.%
5120     GOSUB 6000
5130 NEXT I.%
5140 RETURN
6000 '---------------------------------------------------------------------------------------'
6010 ' This subroutine prints the number in NUM.% as a string                                '
6020 '---------------------------------------------------------------------------------------'
6030 IF (NUM.DATA.% MOD 8) = 0 THEN WRITE.IF.%=TRUE.% ELSE WRITE.IF.%=FALSE.%
6040     WRITE.ELSE.% = NOT WRITE.IF.%
6050     WHILE WRITE.IF.%
6060         CHECK.INDEX.% = 1 + NUM.DATA.% \ 8
6070         PRINT#2, ""                    'Go to the next line
6080         PRINT ".";
6090         PRINT#2, DATA.BASE.%+INT(10*(NUM.DATA.%\8));
6100         PRINT#2, "DATA"; CHR$(9);
6110         WRITE.IF.% = FALSE.%
6120     WEND
6130     WHILE WRITE.ELSE.%
6140         PRINT#2, ","; CHR$(9);
6150         WRITE.ELSE.% = FALSE.%
6160     WEND
6170 NUM.$ = STR$(NUM.%)
6180 IF NUM.% >= 0 THEN NUM.$ = RIGHT$(NUM.$, LEN(NUM.$)-1)
6190 PRINT#2, NUM.$;
6200 IF DO.CHECK.% THEN CHECK.%(CHECK.INDEX.%)=CHECK.%(CHECK.INDEX.%) XOR NUM.%
6210 NUM.DATA.% = NUM.DATA.% + 1
6220 RETURN
```

Figure 3.

```
100 READ LENGTH.%, CHECK.SUM.%, FILE.NAME.$
110 NUM.LINES.% = (LENGTH.% + 7) \ 8
120 DIM CHECK.%(NUM.LINES.%)
130 FOR I.%=1 TO NUM.LINES.% : CHECK.%(I.%)=0 : NEXT I.%
140 PRINT "Checking";
150 FOR I.%=1 TO LENGTH.%
160   READ BYTE.!
170   IF BYTE.! > 255 THEN 210
180     BYTE.% = BYTE.!
190     CHECK.%(1+(I.%-1)\8) = CHECK.%(1+(I.%-1)\8) XOR BYTE.% : GOTO 230
200   '
210     PRINT : PRINT "Line";1010+10*((I.%-1)\8)0!;"may have a missing comma."
220     PRINT "Writing stopped." : GOTO 480
230   IF (I.% MOD 8 = 1) THEN PRINT ".";
240 NEXT I.%
250 PRINT
260 ERROR.%=0                               'No error yet
270 FOR I.%=1 TO NUM.LINES.%
280   READ CHECK.% : LINE.CHECK.% = LINE.CHECK.% XOR CHECK.%
290   IF CHECK.%(I.%)<>CHECK.% THEN PRINT "Line";1000+10*I.%;"May be bad":ERROR.%=-1
300 NEXT I.%
310 IF LINE.CHECK.% = CHECK.SUM.% THEN 330
320 PRINT "Data may be bad in data starting at line 10000" : ERROR.%=-1
330 IF ERROR.% THEN 480
340 OPEN FILE.NAME.$ AS #1 LEN=1
350 FIELD #1,1 AS BYTE.$ : PRINT "Writing";
360 RESTORE 1010                            'Restore all except for first line of data
370 FOR I.%=1 TO LENGTH.%
380   READ BYTE.%
390   IF BYTE.% <> -1 THEN 430
400     READ COUNT.% : LSET BYTE.$ = CHR$(0) : I.% = I.% + 2
410     FOR J.%=1 TO COUNT.% : PUT #1 : NEXT J.%
420     READ BYTE.%
430   LSET BYTE.$ = CHR$(BYTE.%) : PUT #1
440   IF (I.% MOD 8 = 1) THEN PRINT ".";
450 NEXT I.%
460 CLOSE
470 PRINT : PRINT FILE.NAME.$;" created"
480 END
```

Figure 4.

```
1010 DATA    180,    6,      176,    0,      183,    7,      185,    -1
1020 DATA    2,      182,    24,     178,    79,     205,    51
1030 DATA    210,    50,     255,    180,    2,      205,    16,     205
1040 DATA    32
10000 '
10010 DATA   -12,    191,    185,    32
1000 DATA    25,     -46,    "cls.com"
```

Figure 5.

```
                ASSUME      CS:CODE_SEG
CODE_SEG                    SEGMENT
CLS             PROC        NEAR
                MOV         AH,6        ;Call for scroll to clear screen
                MOV         AL,0        ;Clear screen
                MOV         BH,7        ;Normal attribute
                MOV         CX,0
                MOV         DH,24
                MOV         DL,79
                INT         10H
                XOR         DX,DX       ;Move cursor to top of screen
                XOR         BH,BH
                MOV         AH,2
                INT         10H
                INT         20H
CLS             ENDP
CODE_SEG                    ENDS

                END         CLS
```

Figure 6. ▲

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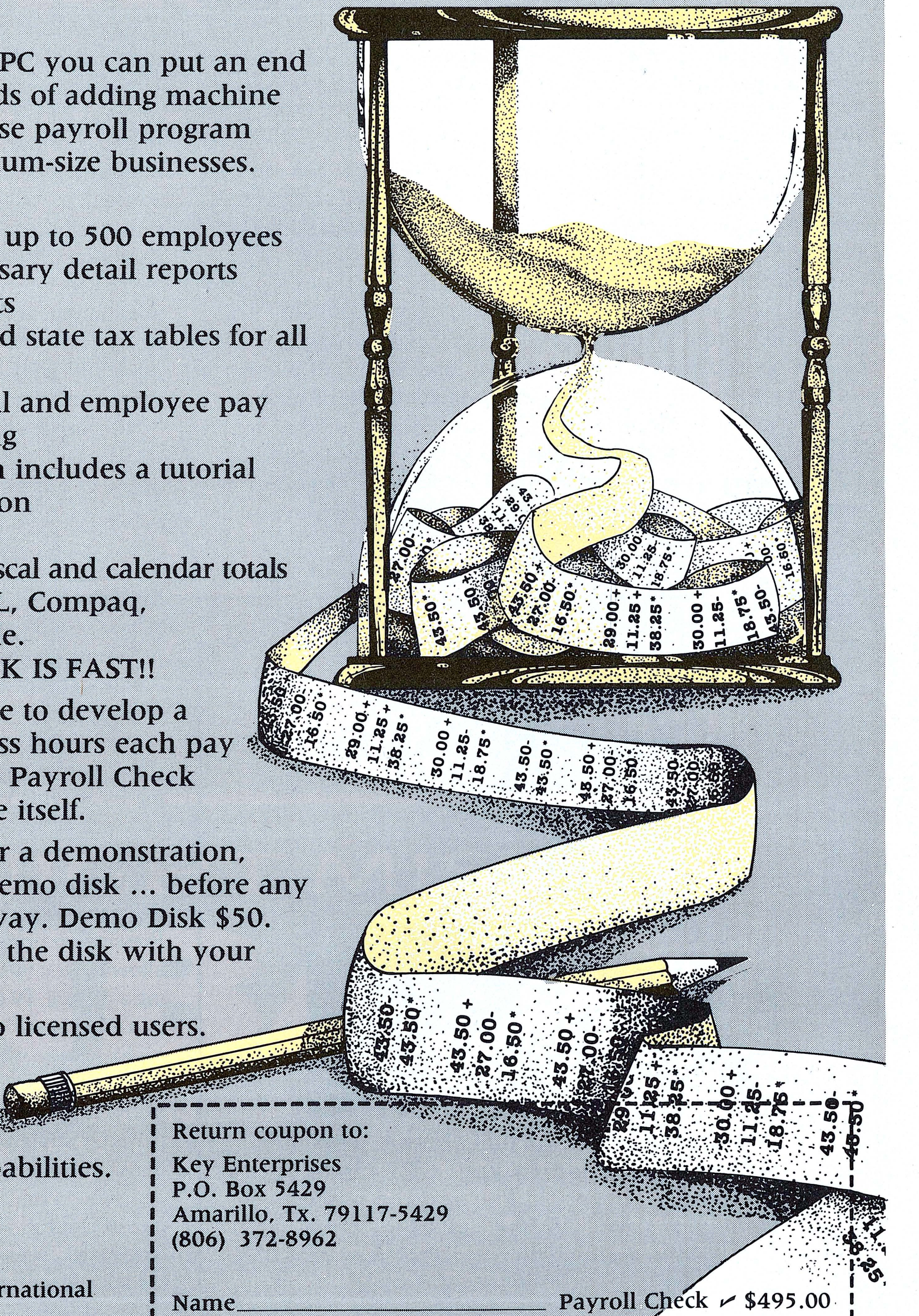

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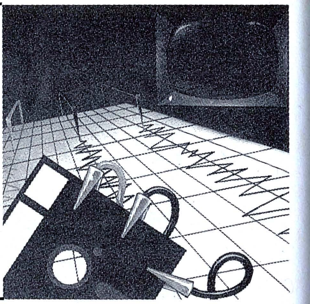

Unless otherwise indicated, software listed runs in DOS 1.1 or 2.0 with either display adapter and requires 64K and at least one disk drive.

BioRhythm

Why leave romance up to hormones and caprice? Now you can trust this important concern to science and discover you and your partner's compatibility ratio—expressed in unarguable percentages—with the ColorBiz *BioRhythm* package.

For example, you don't want to choose a true love that is too emotionally congenial—that would be stultifying—but you do want to find someone 100 percent congenial physically and intellectually. If you left true love up to chance, who knows what kind of mistake you might make. The ColorBiz *Biorhythm* documentation, which must have been written by the people who write fortune cookie blurbs, stresses that "intellectual congeniality is important for a long collective life."

The program—written in Basic—prints out very handsome biorhythm analyses both on-screen and on the printer; if you have a color monitor, your biorhythm is charted in vivid blues, greens, and reds. Little hearts, heads, and bodies indicate the emotional, intellectual, and physical curves, giving graphic indication of when you are about to plummet or rise. You can display your chart prominently so that "employees and friends can be warned in advance by persons who are aware that, for example, they are about to enter an emotionally critical time, thus preparing these people for the possibility of unpleasant behavior on the part of the person giving the warning."

The documentation may prove confusing for those of you who have not committed Bernard Gittelson's *Biorhythm: A Personal Science* to heart. However, the program itself makes for lively fun at home or at the office, and is certainly something to show those friends of yours who wonder just what it is your computer can do.

Because *BioRhythm* uses text graphics, it works on both monochrome and color displays. You can print the chart out if you have access to a printer. KTJ

ColorBiz *BioRhythm*, ColorCorp (208 North Berkshire, Bloomfield Hills, MI 48013; 313-335-2255). $29.95.

ES Painter

If you're looking for a little sketch program, or you'd like a good beginning graphics tool for the kids in the house, be sure to look at *ES Painter.* This program is simple, straightforward, and very easy to understand.

ES Painter uses a standard joystick with on/off buttons to control a screen cursor and draw lines. You can color-fill the finished line drawing by moving the cursor to the desired location and pressing the F8 key, which displays prompt lines asking for the paint and boundary colors.

Background and line colors are changed with function keys F1 through F4, and you can change the current palette by pressing F7. Pressing F6 brings up prompts for drive identifier and picture name, allowing you to save your work. F5 shows similar prompts for displaying a picture, F9 erases the screen to the background color, and F10 lets you erase specific pictures from a designated drive.

ES Painter is reminiscent of an electronic Etch-A-Sketch, and it has some of ths same problems. Since the program requires you to draw freehand, without setting up starting and ending line points, drawing perfectly straight lines is not easy. Smooth curves and perfect circles may not be impossible, but they're damned difficult. Of course, much depends on the quality of the joystick and your ability to handle the on/off control. The program is definitely easier to use with a self-centering stick, since line drawing stops—even if the joystick is on—when the stick is centered. Line drawing is a bit slow, but that may actually be an advantage for novice users because they're not so apt to find the joystick getting away from them.

The package comes with a disk of nine simple drawings for children to color in—including a clown, butterfly, car, and horse. Neither this nor the program disk is copy-protected, and the manual expressly licenses users to make backup copies for one machine. The program disk is sealed into its jacket with a licensing label, a practice that is becoming common with distributors.

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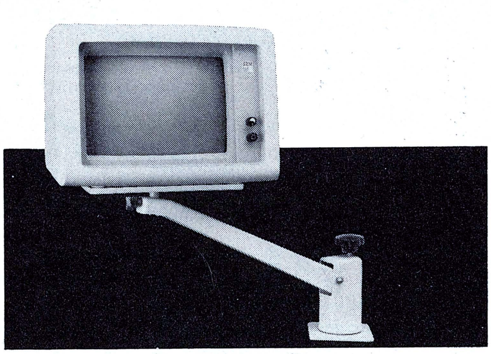

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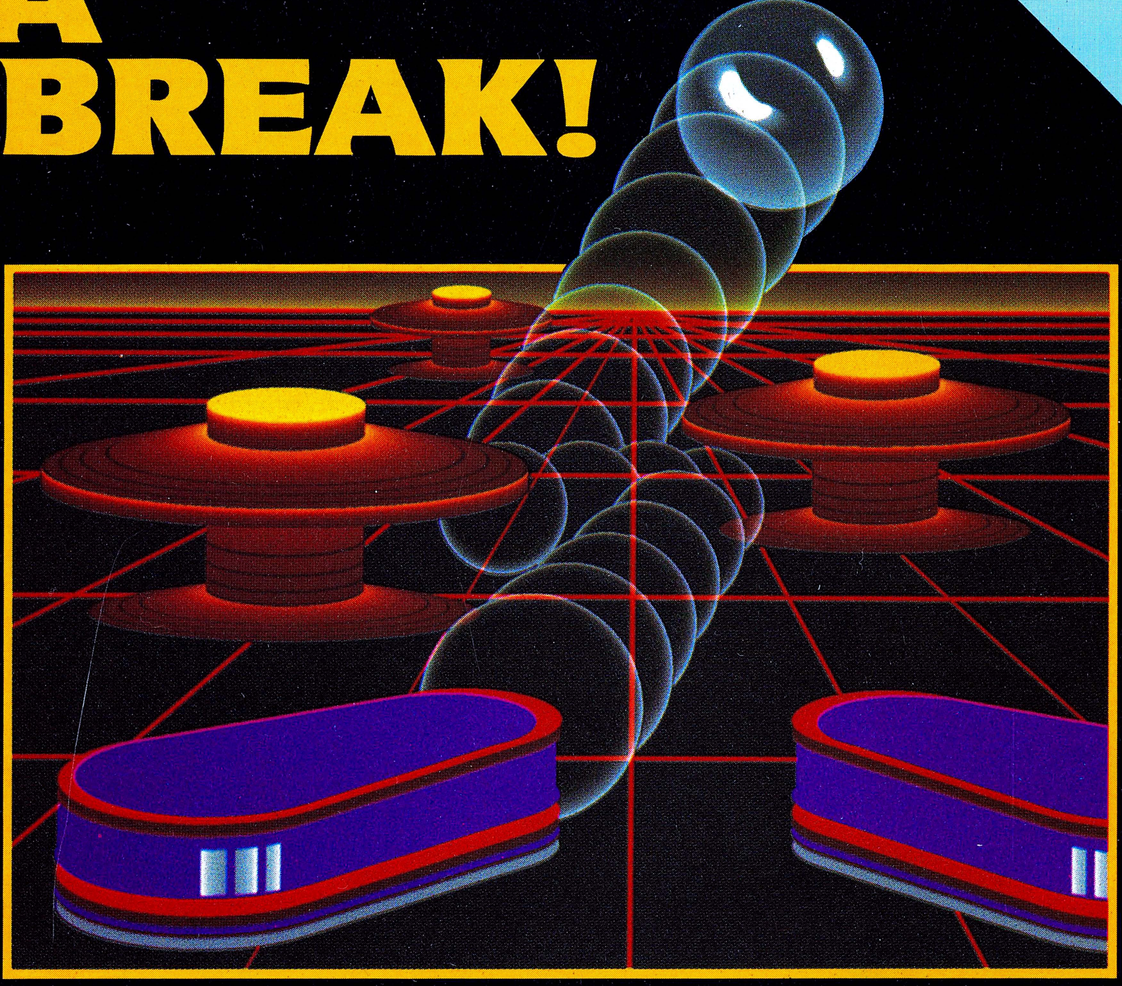

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The twenty-five-page manual is well written and easy to understand; it would probably present no problems for most ten-year-olds, although parents might want to supervise such activities as installing DOS on the program disk and making backup copies.

All in all, *ES Painter* is a good introductory program for the budding graphics enthusiast. Even small children will enjoy moving the joystick around to create lines, and older users will find it a useful sketching tool. DC

ES Painter, E&S Software services (Box 238, Bedford, MA 01730; 617-275-8534). $45.

Graphics Utility

Graphics Utility is one of those packages that fall through the cracks. It's a little simplistic for an experienced programmer and a bit confusing for a novice. The four graphics programs on the disk let the user create small medium-resolution figures, save and combine them, and use them in simple animation. The programs are in interpretive Basic and aren't copy-protected, so users can make backup disks easily and can study the code to see how it operates.

Graphics Utility uses a grid approach for its drawing; users fill in the squares with any of the three available palette colors. The *Graphics Utility* grid can be from 1 by 1 to 39 by 39 medium-resolution pixels, which allows good control in designing characters.

The character-generation program, Chardraw, prompts for the grid size and the name of the file where the figure will be stored. It then assigns a number to the figure, depending on the order of generation. This number is used by the other programs to locate the figure in the file. Figures can be created or edited, but there is no provision for deletion. They also can be copied and stored under new names, which makes creating animated sequences easy.

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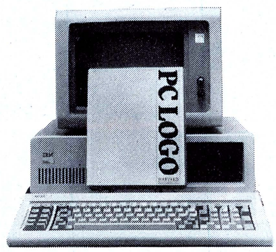

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The cursor can be moved only horizontally and vertically when you are drawing a figure, since the 7, 9, 1, and 3 keys on the ten-key pad are used to move it directly to the four corners of the grid. Each square passed over by the cursor is filled in automatically, and figures can be drawn rapidly. A reverse function swaps the filled-in squares to the background color or back again. You have to be careful with this function when you're working with multiple colors, but it can be useful. An actual-size display of the figure appears at the top right of the screen as the drawing is done on the grid, allowing you to see how the character will look on the color display.

Charanim, the animation program, accepts up to eight figure-numbers, prompts for movement speed, then displays the figures in sequential positions across the screen, left to right, creating animated movement. There is no way to create diagonal movement or change the movement direction, but the speed can be varied, and Charanim also prompts for the palette.

The Chargrup program combines several of the small characters into one large figure. Using it requires a little planning, since you have to enter the horizontal and vertical positions for each character to be used. The combined figure can be stored and later retrieved with the Chardisp program. Chardisp displays only grouped figures. If a single character is to be displayed, it must be grouped singly; there's no other way to show it off the grid.

Four subroutines included in the package can be included in your own programs and provide for storing a character in an array, reading it back out, displaying it on the monitor screen, and displaying characters in sequence as an animated routine. This gives you the flexibility of creating figures with *Graphics Utility* and then reading them into an array for use in games or presentations.

Each subroutine has a comment section that tells you what values to insert in the code. The code itself is not commented, however, and would be hard for a beginner to understand. The longest routine is ten lines of code, the shortest only two. All routines are simple enough that an experienced programmer could write them from scratch in an hour or so, but beginners will find them useful.

The manual is small and obviously intended for users with experience in Basic graphics. The information is straightforward and complete but not sufficient for inexperienced users. A demo file on the disk is referred to as part of a tutorial, but the manual switches back and forth between discussion of the demo files and advice on creating new figures, and this is confusing.

Graphics Utility has limited capabilities, but it does what it does quite well. The program is attractively priced, and it could prove useful for people who have the need or desire to draw many small, medium-resolution characters. DC

Graphics Utility, Savant Software (Box 440278, Houston, TX 77244; 713-556-8363). $85.

Jogger Logger and Running Log

Dedicated runners like to keep track of their progress; the not so dedicated need something to help them stay the course. Two software logs can help both groups keep track of their victories.

Jogger Logger is a no-frills running log; it does little more than keep track of your miles and minutes. It tallies your daily record, along with a twenty-character comment, and generates monthly and yearly tables. The tables display up to fifteen records per month; any more than that and the table scrolls, making the column heads and your previous times invisible. You may find this scrolling a little inconvenient, but it's nothing that control-num-lock won't remedy.

The *Running Log* offers more. Its set-up module allows you to record some or all of nine basic descriptions of your daily run—your morning pulse, the route, the shoes you wore, the distance, the time, your weight, and so on. You can even make your own category and

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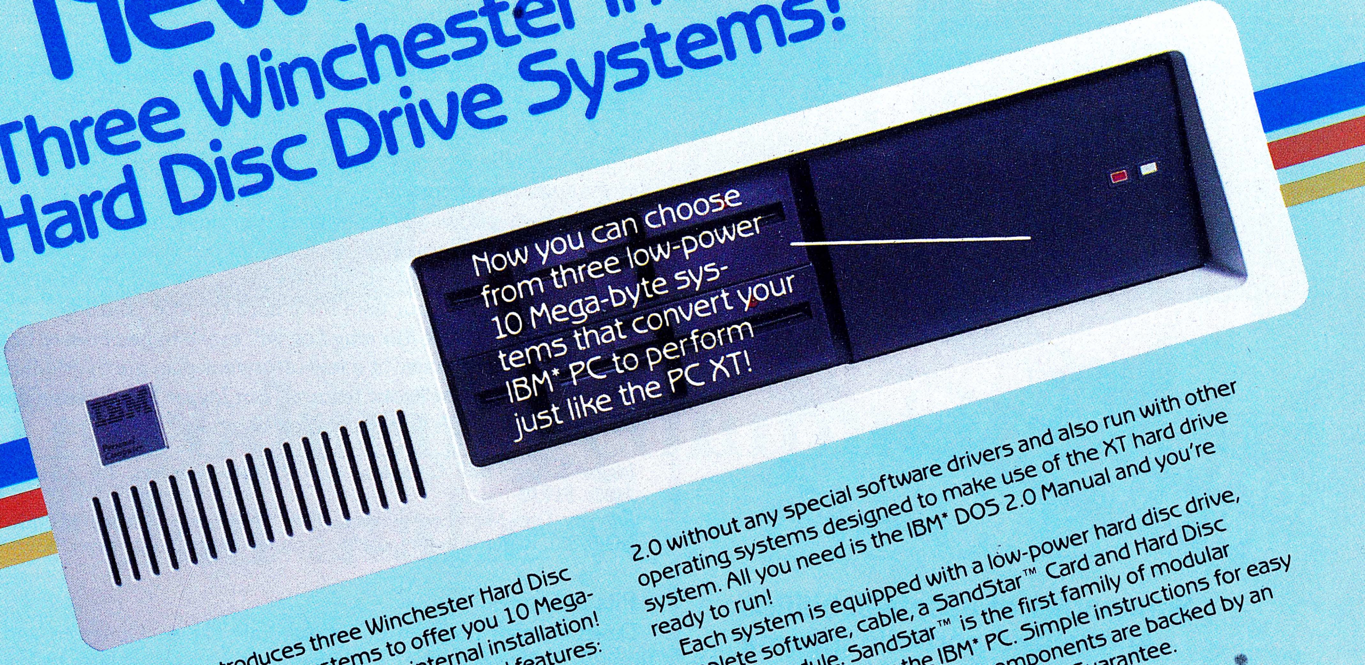

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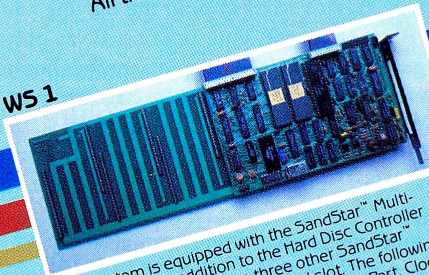

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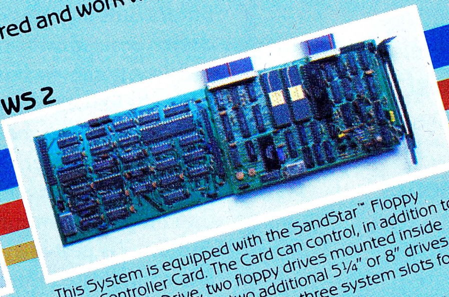

This System is equipped with the SandStar™ Floppy Drive Controller Card. The Card can control, in addition to the Hard Disc Drive, two floppy drives mounted inside your PC and optionally two additional 5¼″ or 8″ drives mounted externally. This leaves three system slots for other expansion boards.

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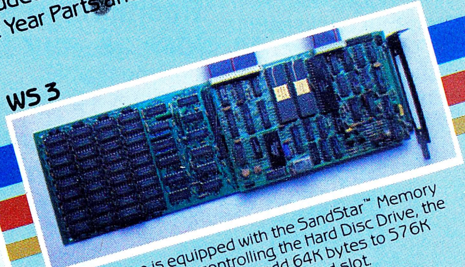

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include some additional variable you find important. There is room for a fifty-character comment ("Robins on the field this morning," "Toughs with chains and baseball bats," "Frost on the grass," "Stiff headwind"). These last two features provide room for a little subjectivity and almost make a diary out of *Running Log*.

Once you have input all this information, you can summon it from the log-viewing menu, which keeps a running (so to speak) total of your miles run for the current year. One item not included that you might miss is your rate of speed; there is no place to input how long it took you to run those two miles. Also, the *Running Log* consistently mismatches the day of the week with the calendar date—which could cause some initial confusion.

The menu allows you to generate various kinds of reports from the data you've input: miles per week, miles per year, analysis per period (from two to three hundred sixty-six days), consecutive running rates. You can then print your data for a hard copy of your log.

Jogger Logger and *Running Log* will prove to be of use to both novice and seasoned runner (if a few inconveniences are overlooked). The *Running Log* has the exotic features, but *Jogger Logger* costs less. Both packages come with documentation helpful to the novice. KTJ

Jogger Logger, BBE Company (Box 771448, Houston, TX 77215; 713-270-7485). $19.95
Running Log, Marathon Software (Box 26 Pinecrest, Clancy, MT 59634; 406-933-5783). Requires color/graphics adapter and two disk drives. $39.95.

Pits & Stones

Desert nomads don't go in for elaborate games. Dungeons and Dragons? Too silly. Scrabble? Too many little wooden squares to lose in the shifting sands. Monopoly? Takes too long to play. Croquet? Too little grass in the desert. Bridge? Who wants to haul a card table around on a camel?

No, the tribesmen engage in simple, straightforward pursuits. Games similar to those we know as go, checkers, or even chess. *Pits & Stones* falls into this category except that, instead of some rocks and a desert, you now need a microcomputer with 128K—more memory than some camels have.

In the game's original incarnation, however, no songs tootled as you won or lost, and the stones did not scoot around the playing squares under their own power. And, of course, your opponent was only human. In this PC version you have a choice of playing another human or the computer. Not surprisingly, the computer is an excellent player. *Pits & Stones* is perhaps a little more complicated than checkers and a lot less complicated than chess. This means that the PC can look several moves ahead without the mind-boggling silences that punctuate most chess programs.

The rules are simple, and they are thoroughly explained by the program itself on request. A quick-reference summary is also available. The stones are represented by the happy face from the regular PC character set, and children should enjoy seeing them skitter from square to square. Very young children may find the game a bit abstract, although the company's description refers to a three-year-old who loves to play. The difficulty level increases with the number of stones used for play, and adults should have no trouble finding a challenging level. After losing enough times to the computer, most players will probably want to take it out on an unsuspecting human opponent.

Because the game uses only the standard character set, it runs on both monochrome and color screens. If you tire of hearing the songs, you can turn them off.

The best thing about *Pits & Stones* is that you don't need your computer to play. A handful of pebbles and a markable playing surface work just as well, so if you do find yourself in a desert, at least you'll have a way to pass the time. JB

Pits & Stones, by Russ Blake, Orion Software (Box 2488, Auburn, AL 36831; 800-821-8088). $36.95. ▲

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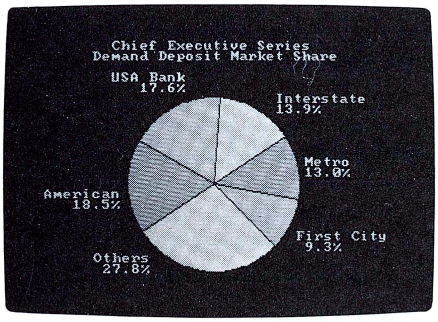
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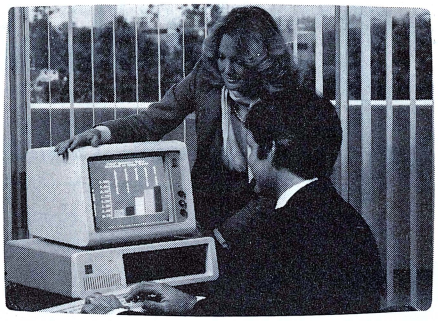

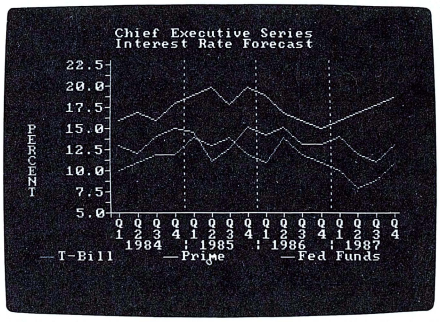
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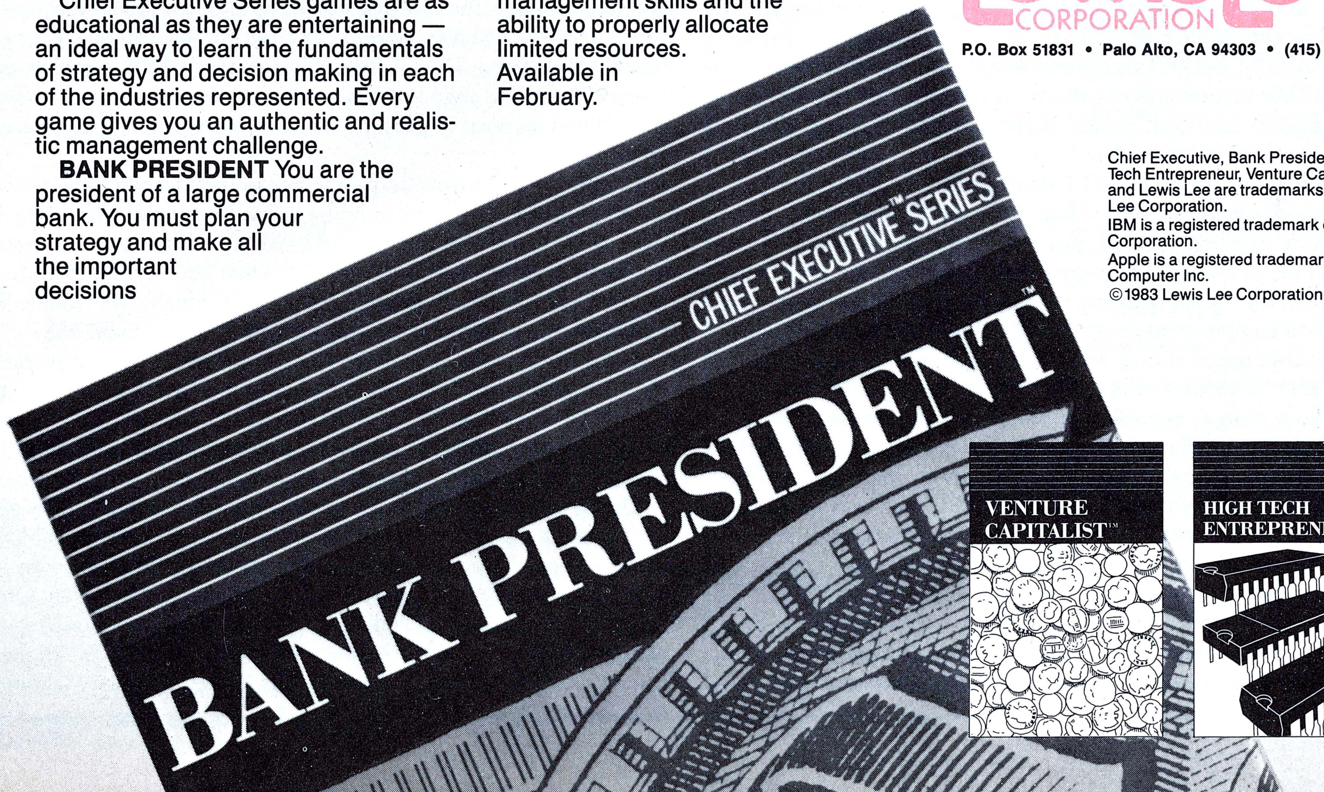
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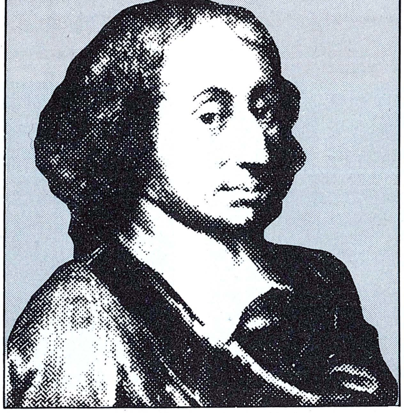

FROM BEGIN TO END

by Bruce Webster and Deirdre Wendt

UCSD Pascal: An Update

Well over a year ago, we did a comparative review of IBM Pascal and UCSD Pascal, both as published by IBM (see "IBM Pascal vs. the UCSD p-System," July 1982 and September 1982). Since that time, IBM has released an updated version of UCSD Pascal, and Network Consulting, Incorporated, has released its own implementation of the p-System. The changes and additions, especially in the NCI product, warrant a fresh look at UCSD Pascal and its attendant operating system. We'll start with a brief recap of the p-System, follow that with a look at NCI's implementation, and finish up with an update on the IBM version of the p-System.

Recap. UCSD Pascal is so named because it was developed at the University of California at San Diego by a group of students working under the direction of Dr. Kenneth Bowles. The principal goal of the UCSD group was to produce a complete system for developing Pascal programs on a single-user minicomputer or microcomputer. Achieving portability between systems was another major goal. The results were the UCSD Pascal compiler and the p-System, an operating system geared specifically to Pascal program development and execution.

Since its beginnings at UCSD, the p-System has gained a broad, if limited, acceptance. Two firms have been primarily responsible for its promotion: Apple Computer, which has sold more than eighty-thousand copies of Apple Pascal (a version based on version II.0 of the p-System), and SofTech Microsystems, which has developed the p-System to version IV.2 for every major microprocessor on the market. Both the IBM and NCI versions of the p-System were licensed from SofTech. IBM's version is pretty much unchanged; NCI's incorporates some significant revisions, mostly in the direction of speed enhancement.

The unique feature of UCSD Pascal (and the p-System) is that it doesn't compile programs into machine code for the processor on which you're working. Instead, programs are compiled into *pseudo-machine code*, or *p-code*. This p-code is the machine code of an imaginary sixteen-bit, stack-oriented microprocessor. No matter what machine you compile your program on, the p-code it produces will be the same (assuming, of course, that you're using compatible versions of the compiler). Code files compiled on one machine can be run on another without change, regardless of difference between processors.

How is this accomplished? Each processor has its own *p-code interpreter*, a small program written in the processor's machine language. The interpreter executes the p-code, translating p-code instructions into machine-specific actions. Since the entire p-System is written in Pascal (and therefore is all p-code), you need only to write a new interpreter (with I/O routines) to transport the p-System to a new processor.

The p-System is an entire operating system, with utilities for editing, compiling, linking, managing files, assembling, and other activities. Since the system's *raison d'etre* is program development, its various functions work together in a fashion not often found elsewhere. A small example: If the compiler encounters an error during compilation of a program, it stops and gives you the opportunity to use the editor. If you choose to do that, the editor jumps to the spot where the error was found and tells you what type of error it was. You can then make the correction, get out of the editor, and start the compilation over again.

Three major criticisms are commonly leveled at the p-System.

First, since p-code is interpreted, p-System programs run slower than equivalent programs in directly executable machine code.

Second, p-System files are incompatible with CP/M-86 and MS-DOS. Developers of commercial applications must either license (and sell with the program) the p-System or depend on end users who already own the p-System.

Which leads to the third criticism: The p-System costs too much. SofTech has taken steps during the last year to reduce the cost. They've introduced, for example, a $60 runtime version of the p-System (that is, one without compiler or utilities but capable of running p-code files). Nevertheless, licensing fees remain a stumbling block.

If you want to market a program written in UCSD Pascal, you pretty much have to include the runtime p-System with it, since relatively few people own either the full package or the runtime system. This means paying SofTech a per-copy royalty ranging roughly from $1 to $10, depending on estimated sales volume. What's even more painful, though, is the fact that you have to pay a license advance of from $10,000 to $50,000 *up front*! By contrast, you can buy a copy of Pascal/MT+ (from Digital Research) for about $300, develop programs with it, and market them, without ever paying a penny more (though you *do* need to put a notice on disk identifying DRI as copyright holder).

Despite these burdens, the p-System has gained a noticeable following. It's good for developing in-house software, especially if you have a variety of systems using a variety of processors. And because program development is its main purpose (rather than an afterthought), the p-System is also good for novice programmers. Finally, it's reliable and predictable. Since p-code was designed with Pascal in mind, the UCSD compiler has a much easier task than does a compiler that compiles Pascal to 8086 code. There are compiler bugs in both IBM Pascal and Pascal/MT+, but UCSD Pascal is solid as a rock. Also, the p-System (as published by IBM) has far better documentation than any of the other IBM PC operating systems.

The NCI Version. NCI, a firm located in British Columbia, has been running ads for an improved version of the p-System for the IBM PC. The company claims to have rewritten the p-code interpreter to run significantly faster than (up to twice as fast as) the IBM version. Other improvements claimed include support of the 8087 coprocessor and disk emulation. This implementation is based on version IV.1 of the p-System (the IBM implementation is based on IV.0), so many (although not all) of the enhancements came from SofTech.

The following review of the NCI system is based on use of the system on a Compaq equipped with two 320K drives and 256K of RAM.

The first thing you notice is the increase in speed. Not only is the interpreter faster, but it automatically sets up a RAM disk (258 blocks), copies system files to it, and sets it up as the boot disk. As a result, the entire system runs with a minimum of disk access.

The next impressive feature is the Config program. This handy little item does it all: It formats disks, partitions memory, assigns devices, you name it. What's more, it formats disks to hold either 400K or 320K, as you choose. You can use both formats interchangeably; the system automatically recognizes each one and adjusts accordingly. And, of course, it reads the 160K and 320K disks formatted under the IBM version. It also supports a hard disk, allowing you to divide it into as many as sixteen volumes.

To go along with the increased disk capacity—and hard disk support—the NCI version allows *subsidiary volumes*, or subdirectories. In essence, it takes a chunk of your disk (floppy or hard) and makes it look like a separate disk, directory and all. There's a good reason for doing this: p-System directories can hold only seventy-seven files. That's fine for a 160K floppy but inadequate for a 400K floppy (not to mention a 10M hard disk).

These chunks appear as files with the extension *⟨name⟩.SVOL*. When one is mounted, it becomes the volume *⟨name⟩:* and is treated like any other disk volume. At boot time, all SVOLs on any disks in the machine are automatically mounted.

You can also mount and dismount SVOLs directly using the new O)nline command within the Filer. SVOLs are easy to set up: Just use the Filer's M)ake command to create the file *⟨name⟩.SVOL*. That's it. One word of caution, though: Nesting of SVOLs is not allowed.

Yet another nice feature is support of the 8087 coprocessor. The package includes versions of the interpreter, REALOPS unit, and Turtlegraphics that take advantage of the 8087, supporting both two-word and four-word real numbers. The documentation also mentions an 8087 version of the native code generator, but our review disks had just the 8086-only version. The assembler, of course, also supports the 8087. (Unfortunately, we were unable to test the system with an 8087.)

The increased speed of the NCI version is significant. A heuristic search program, modified so that it would repeat the searching code ten times (for greater timing precision), ran more than 1.5 times faster on the NCI system than on IBM's p-System (see figure 1). For a further test, the program was recompiled with the {$N+} compiler option, and the native code generators (NCG) for both systems were run. The times: 30.9 seconds for IBM, 30.0 seconds for NCI. In other words, the NCI p-code version ran almost as fast as the IBM NCG version.

	IBM VERSION	NCI VERSION
p-code	52.6 seconds	33.9 seconds
native code	30.9 seconds	30.0 seconds

Figure 1.

The NCI version also gives you many utilities and libraries. These include programs and units for file transmission and telecommunications, clock and date handling, sorting, file management, and so on. Some of these have bugs in them (the remote terminal program, for example), but these are for the most part labeled in the documentation. The best part is that in many cases the source code is included! This means that you can modify the programs and/or units to do just what you want them to, or, more important, you can see how certain things are done so that you can do them in your own programs.

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Now for the bad news.

First, the NCI version is expensive. The May 1983 price list quotes $845 for the p-System plus Pascal. However, you may feel the extra cost is justified by the savings in development and execution time. (Note: Titan Technologies has introduced an Accelerator card for the IBM PC, which is an alternative way to get increased speed.)

Second, the NCI documentation leaves much to be desired. The package included a binder of NCI documentation (IBM standard size) and reprints of three SofTech documents--User's Guide, User's Guide Supplement (for IV.1), and Internal Architecture Guide. The only index to the NCI document is a key-word-in-context (KWIC) list, which often proves to be inadequate.

The documentation itself is divided into five sections (utility, system, library, information, and operations). The first four sections are organized alphabetically by program or topic name; the fifth section has a table of contents. Each program/topic has its own page numbering (in other words, each section starts with page 1). This numbering method makes it easy for NCI to update the documentation (just pull or add topics as needed, then update the KWIC listing), but has two big drawbacks: If you can't find what you're looking for in the KWIC listing, you're going to have to do a lot of searching; and related topics aren't necessarily near each other, so you may find yourself skipping around a lot and constantly referring to the KWIC. What's worse, once you've found the correct section, it may not tell you much.

Furthermore, the printing is ugly (photoreduced computer printout) and unpleasant to read. Even an experienced p-System user is likely to have trouble getting information out of this manual for the first few weeks (after which he may well choose to leave it alone); p-System novices should steer clear.

Even with all these gripes about the documentation (which, may have been improved by the time you read this), the NCI version of the p-System is the way to go. For current information, you can contact them at:

Network Consulting, Inc.
Discovery Park, Suite 110
3700 Gilmore Way, Burnaby
B.C., Canada V5G 4M1.

IBM p-System Update. After receiving the NCI version, we attempted to get the latest IBM-distributed version of the p-System from Softech (they had to request it from IBM). As mentioned earlier, this p-System documentation (five binders) is among the best for any computer product. (It was *not*, incidentally, written at IBM, which is legendary for poor documentation; it was produced by SofTech.) One entire binder (and one of the six disks) is devoted to teaching beginners the use of the p-System, while the other four (User's Guide, Pascal Reference, Assembler Reference, and Internal Architecture) tell you just about everything you need to know in clear, well-written, organized, indexed sections. The arrival of the IBM package made the NCI documentation look all the worse.

However, if the IBM documentation puts NCI to shame, the IBM p-System's performance did much to restore NCI's luster. The system took forever to boot. Once you've used NCI's package for a few weeks, all the IBM system utilities seem slow—especially the Filer (which, under certain conditions, will hang for around ten seconds when you do a V)olume command). The final indignity was that the IBM DISKFORMAT program found errors on all four floppy disks we tried to format; it took NCI's CONFIG program to get the job done.

There are some enhancements to the IBM version (the package included additional pages to insert in the documentation), but not nearly as many as one might have hoped. It will automatically create a RAM disk, but it does not do the automatic file copy and redesignation of boot volume that the NCI version does. Other changes include two new procedures in the unit IBMSPECIAL to allow you to select which printer port you want for the PRINTER: volume (#6:) and which serial port you want for REMIN: (#7:) and REMOUT: (#8:). That's about it.

And it's still based on version IV.0—which means no subsidiary volumes. In fact, the documentation makes no mention of hard disks; can you use it on an XT?

All this has left some folks at SofTech feeling understandably frustrated. You see, they do not currently distribute the p-System directly for the IBM PC. Instead, IBM has licensed it and distributes it. This means that SofTech has little control over what version IBM uses. Word has it, though, that they (SofTech) are getting close to releasing version IV.2 with improved (!) documentation—and that they might then start directly selling an IBM PC version. Stay tuned.

Conclusions. What's the ideal system? If money's no consideration, then get both: Use NCI's software and IBM's documentation. Assuming real-world constraints, though, we recommend the IBM version for beginners and the NCI version for those already familiar with the p-System and interested in performance.

Coming up in this column: reviews of Pascal/MT+ from Digital Research, and Modula-2 from Volition Systems. See you then. ▲

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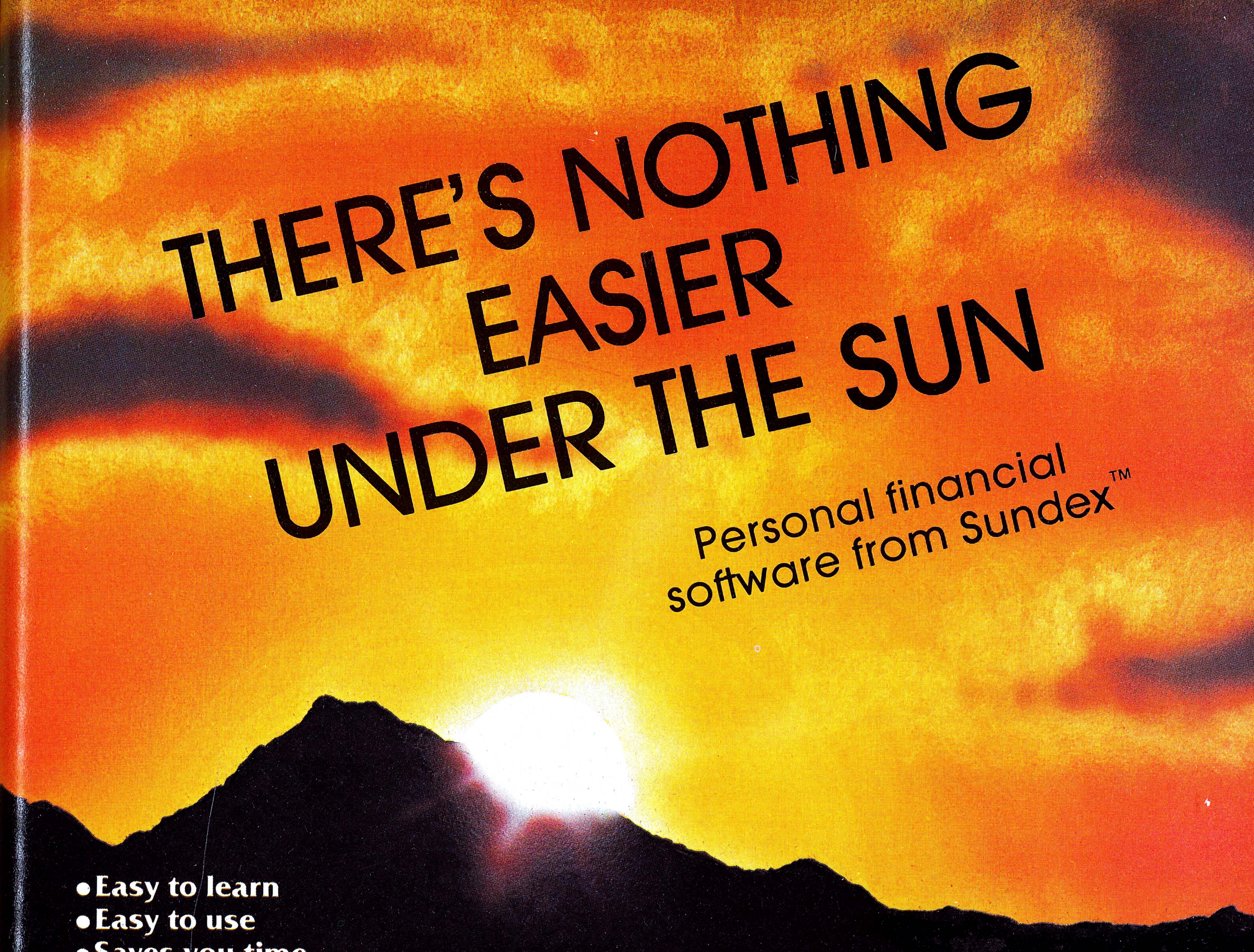
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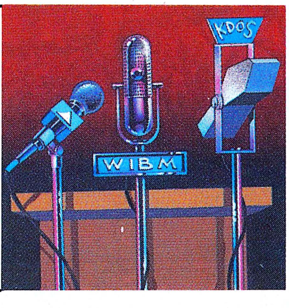

Unless otherwise indicated, software listed runs in DOS on machines with either display adapter and requires 64K and at least one disk drive.

Δ A new version of the *Apple-IBM Connection* program from **Alpha Software** (12 New England Executive Park, Burlington, MA 01803; 617-229-2924) supports the Apple IIe and additional communication cards for the Apple II family—the Apple Super Serial Card and the CCS 7710 card. $250.

Δ A printer control program for the Epson FX-80 and FX-100 has been released by **SoftStyle** (7192 Kalanianaole Highway, Honolulu, HI 96825; 808-396-6368). *Set-FX* takes full advantage of all the features of the Epson FX and can print the full IBM character set, including line graphics, foreign languages, and math and science symbols. $59.95.

Δ Micro/Set '84 is a microcomputer exposition and conference for scientists, engineers, and technicians slated for March 13 through 15 in Detroit, Michigan. Sponsored by the **Engineering Society of Detroit** (100 Farnsworth, Detroit, MI 48202; 313-832-5400), the event will feature exhibits and seminars and will be held at the Society's headquarters in the city's University-Cultural Center.

Δ A purchasing, sales order control, and integrated inventory management system, *Oper8* provides operations management with necessary systems and procedures. From **Selkirk Computing Systems** (17131 Hofer Court, Lake Oswego, OR 97034; 503-241-8448). The system uses *dBase II* as a foundation. Purchasing: $500. Sales order control: $750. Integrated inventory management: $2,250.

Δ **Avant-Garde Creations** (Box 30160, Eugene, OR 97403; 503-345-3043) has introduced *Ultra Plot*, a business-graphics package that converts data into charts and graphs for presentation. Line graphs and bar charts can be analyzed for mean and standard deviation. Scatter charts also provide slope, regression equation, and more. Graphs can be overlaid and lines can be color filled. Supports Epson MX series with Graftrax. $149.95.

Δ An integrated set of fourteen programs called the *Sorting System I* is designed to demonstrate and teach the algorithms commonly used for sorting. From **General Computing** (145 Summit Drive, Cedar Falls, IA 50613; 319-277-7105). The package is geared to schools, from junior high up. Source code included. $45.

Δ *Finger Print* is a plug-in module for Epson and IBM printers that puts numerous print modes at your fingertips. From **Dresselhaus Computer Products** (837 East Alosta Avenue, Glendora, CA 91740; 213-914-5831). The unit offers a selection of printer functions, including compressed type, perforation skipping, fine print, and more. $59.95.

Δ *The Pathfinder* system is a color/graphics computer-aided design system that provides fast solutions to printed-circuit problems, supports schematic creation, nets-list capture, final-form generation, and more. From **Summit CAD** (5222 FM 1960 West, Houston, TX 77069; 713-440-1468). The system can also be used for word processing, communications, and financial planning. Hardware and software: $29,000.

Δ **Data Base Decisions** (14 Bonnie Lane, Atlanta, GA 30328; 404-256-3860) has announced a collection of utilities called *The Inside Track*. Sixty-one programs give the user assembler-assisted speed via subroutines that can be called from Basic or compiled languages. Programs include read/write, display, copy memory, and copy-protect disk routines. Requires 128K with DOS 2.0 and eighty columns. $45.

Δ *Sales Planner* is easy-to-use software for sales professionals from **National Microware** (2102 Business Center, Irvine, CA 92715; 714-752-2344). The program can maintain customer and prospect lists, generate reports, type letters, print labels, maintain appointment schedules, and produce sales forecasts. $295.

Δ Six-and-a-half-inch banner letters in black on white or reverse can be printed with the *PCBanner* program from **Williams Software & Services** (1114 Pusateri Way, San Jose, CA 95121; 408-227-4238). Ideal for small businesses, schools, churches, community clubs, and home use. $30.

Δ The *TK!SolverPack for Introductory Science* is the third in a series of application packages designed for use with the equation-processing program from **Software Arts** (27 Mica Lane, Wellesley, MA 02181; 617-237-4000). The package includes twelve models for solving chemistry, physics, and biology problems. $100.

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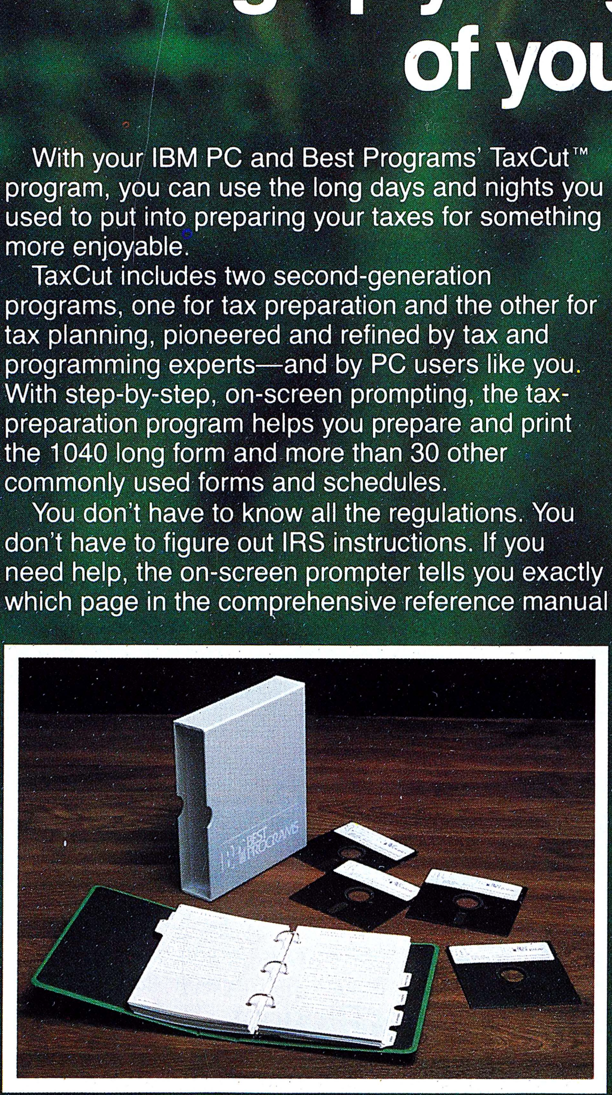

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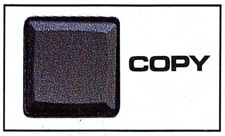

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Innovative, inexpensive, dependable, easy: the Transtar 315. Color printing has never looked so good!

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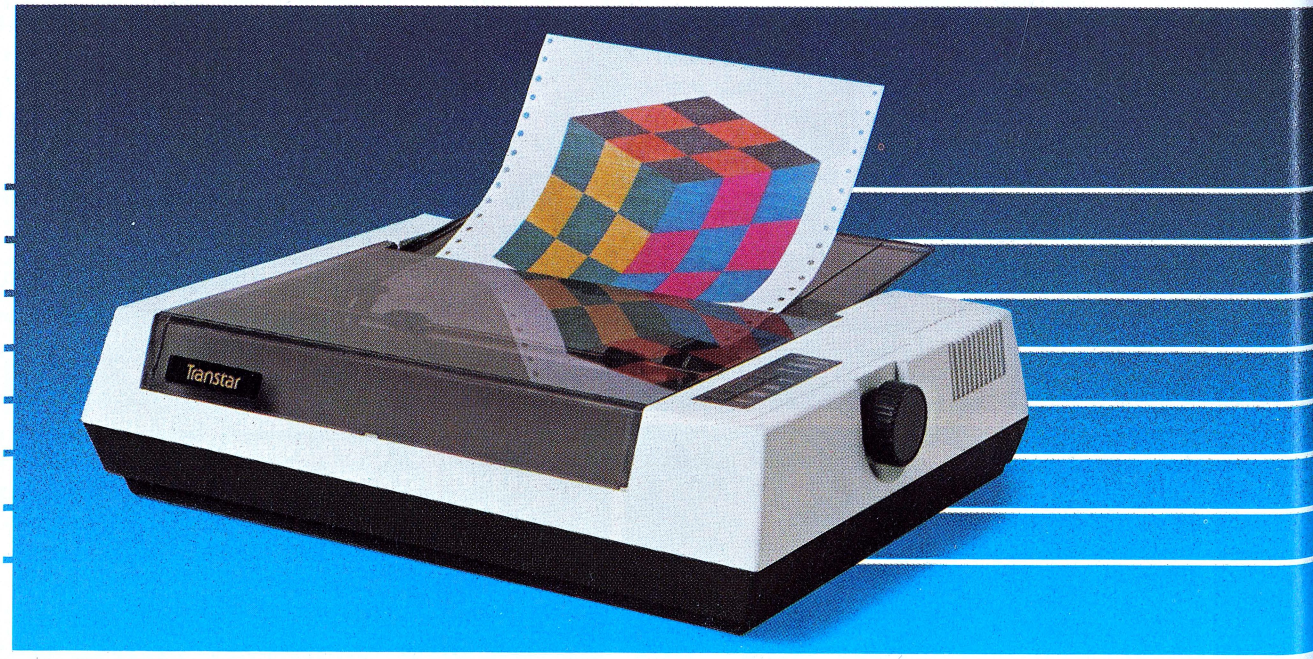

*PICS cards are currently available for Apples and Franklins.
PICS cards for other computers will be available in the future.

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Landing, Larkspur, CA 94939; 415-461-4203). $36 per year.

Δ **Orchid Technology** (47790 Westinghouse Drive, Fremont, CA 94539; 415-490-8586) has introduced some enhancements to its PCnet Local Area Network: The PCnetPlus multifunction board adds an EPROM socket and room for up to 256K of memory on top of the standard PCnet functions. Optional daughterboard provides room for an additional 128K and more. $795. Memory: $50 per 64K. Daughterboard: $895. The PCnetPlus Diskless board allows users to operate without any floppy disk drives. With EPROM socket. $695. EPROM: $150.

Δ An analytical tool from **Duosoft** (1803 Woodfield Drive, Savoy, IL 61874; 800-221-7638) called *Budget Trac* provides on-screen access and hard copy reports of current expense information that relates to budgeted items. Designed to aid managers and administrators involved in day-to-day budget decisions. $495.

Δ Business software from **Holland Automation** (3400-D West MacArthur Boulevard, Santa Ana, CA 92704): *HAI-Bas* is an advanced Business Basic interpreter and compiler. $295. *Filekeeper* is a flexible data management system used to set up application parameters. $195. *HAI-Line* is a set of integrated modules that include general ledger, accounts receivable and payable, inventory, sales analysis, and more. Also available for the XT. $395 to $495. *HAI-Plus* is a set of HAI system utilities. $50.

Δ *International Mail* is a mailing label software package from **Data Consulting Group** (877 Bounty Drive, Foster City, CA 94404; 415-571-8100). The package includes expanded data fields for province/state, country, and postal code; standard size and oversized label support; search and display on selected records based on up to fifteen attributes; and more. Requires two drives. Hard disk version available on request. $95.

Δ *Books! The Electric Ledger* is bookkeeping and accounting software from **Systems Plus** (1120 San Antonio Road, Palo Alto, CA 94303; 415-969-7047). The software allows you to scan or add to the chart of accounts while in the middle of a journal entry and much more. Comes with computer-aided tutorial and sample charts. Requires eighty columns and 132-column printer. $745.

Δ *FilePlan* is an electronic filing system from **Chang Labs** (5300 Stevens Creek Boulevard, San Jose, CA 95129; 408-246-8020) that allows you to enter information in the familiar spreadsheet format. Rows represent records and columns represent fields. Up to fifteen records can be seen at a time. Requires two drives. $295.

Δ *Tax Relief I* is a tax package for individual use that supports fifteen of the most commonly used schedules and forms. $149. *Tax Relief II* is a professional tax package that supports twenty-five schedules and forms, including 1040, 2106, 2119, 2441, and 3468. Requires two drives, DOS 2.0, and 128K. $299. Both are from **Micro Vision** (145 Wicks Road, Commack, NY 11725; 516-499-4010).

Δ *SofTax*, from **Design Trends** (644 Danbury Road, Wilton, CT 06897; 203-834-1560), is a tax preparation and simulation package that uses *VisiCalc* for data entry and what-if calculations. All forms and schedules are printed for direct submittal to the IRS. Requires *VisiCalc*. Individual version: $199. Preparer's version: $499. Professional version: $850. Demo: $25.

Δ A hardware and software system that supports Morse, Baudot, and ASCII codes, the *RM1000 Radio Modem* is intended for use by amateur radio operators. From **Macrotronics** (1125 North Golden State Boulevard, Turlock, CA 95380; 209-667-2888). The software features multilevel split-screen display of transmitted and received text. $149.

Δ Three software packages have been released by **Innovative Software** (9300 West 110th Street, Overland Park, KS 66210; 913-383-1089): *The Smart Data Manager* can create various filing systems and generate reports, forms, mailing labels, and invoices. $595. *The Smart Spreadsheet with Graphics* can handle large amounts of data in many formats. It uses floating-point arithmetic and allows multiple windows to be opened on the screen. Several kinds of charts, graphs, and histograms

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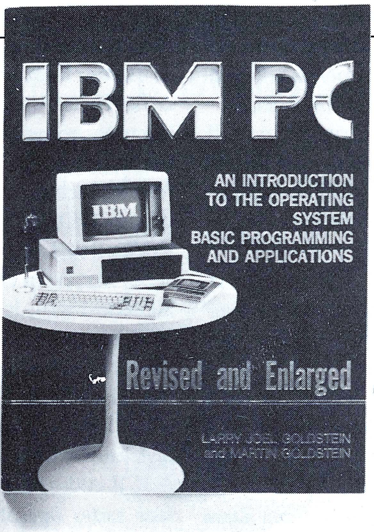
IBM PC
AN INTRODUCTION TO THE OPERATING SYSTEM BASIC PROGRAMMING AND APPLICATIONS
IBM
Revised and Enlarged
LARRY JOEL GOLDSTEIN and MARTIN GOLDSTEIN

IBM PC: An Introduction to the Operating System, BASIC Programming and Applications, Revised and Enlarged
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Clearly, Larry Joel Goldstein, the author, has demonstrated his value by teaching both students and businessmen how to make the most of their personal computers. This updated and expanded version of the classic introductory book for the IBM PC is written in an easy-to-read, self-study format. It has become a best seller because it has been worth its weight in Goldstein to over 100,000 readers, time and time again.

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The author, Dr. Larry Joel Goldstein, is presently a professor of mathematics at the University of Maryland at College Park. Involved in the design and application of computers since 1958, Goldstein is known for his straightforward writing style which makes learning technical subjects easier for thousands of readers. Co-author Martin Goldstein is currently the president of Goldstein Associates, a consulting firm in West Palm Beach, Florida.

Dr. Goldstein has proven to be a prolific author, having written many books and created specialty software for the computer. And, the professor has won numerous awards for his teaching. That teaching glitters in all of his efforts.

Among the Goldstein volumes that will gild your library are:

"Advanced BASIC And Beyond for the IBM PC: Programming and Applications" 1983/400pp/paper/ISBN 0-89303-24-3/D3243-5/$19.95

"Compaq Portable Computer: User's Guide" (co-author Joseph K. Rensin) 1983/320pp/paper/0-89303-389-8/D3898-6/$18.95

SOFTWARE

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ISBN 0-89303-266-2/D2662-7/$95.00

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can be printed or plotted. $595. *The Smart Word Processor* contains features found in dedicated word processors. Multiple documents or parts of documents can be moved between windows on the screen. Graphs and charts generated from *Smart Spreadsheet* can be incorporated into documents. $475.

∆ **Panasonic** (One Panasonic Way, Secaucus, NJ 07094; agency 212-546-2041) has entered the peripheral market with a line of hardware that includes two printers, two plotters, and five monitors. Products are aimed at the small-business segment of the buying public.

∆ *Bomb Zone* is an arcade game from **Fantasy Research** (2028 Casa Loma Court, Grapevine, TX 76051; 817-488-9313). Object of the game is to overcome all the obstacles and constraints to defeat the menacing killer drones. Requires color/graphics adapter. DOS 2.0 version requires 96K. $24.95.

∆ An arcade-style adventure in the Bermuda Triangle, *Sailing* is a fast-action sailing simulation where you maneuver a small boat through the waters of the Caribbean in a race against time. From **Accupipe** (222 West Lancaster Avenue, Paoli, PA 19301; 215-296-7376). Obstacles include creeping mists, demonic storms, gravitational vortexes, and more. Requires color/graphics adapter. Requires 128K. $34.95.

∆ Specialized multiuser application software from **Bluebird Systems** (6352 Corte Del Abeto, Carlsbad, CA 92008; 619-438-2220): *VanS* is a day-to-day business package for the van and storage industry. Handles driver, line haul, payment reconciliation reports; job costing; and more. Price to be announced. *The CPA Package* is a completely integrated, menu-driven set of five modules that include client write-up, payroll, and accounts. Selected client asset reports can be printed automatically. $5,595. *The StockMate* system consists of integrated accounting modules and a distribution module made up of order entry, invoicing, and inventory control. $795 to $1,295 per module. *The Auto Rental Package* can handle fleet control in any rental car operation, including multiple rental offices and fleets, with between 100 and 2,500 vehicles. Handles rental, check-in, car sales, and more. Price to be announced. The multistation word processing package called *The Word Manager* allows a printer to be used at each station. Includes all standard word processing features and can be tailored to specific needs. $695. *The Bluebird Medical Practice Management System* handles patient billing, collection of data, patient scheduling, and more. $5,995. *The Manufacturing Software System* is a set of thirteen integrated modules for handling accounting, production control, order entry, inventory control, and more. Includes planning and tracking of material for shop production. $500 to $4,000 per module. Complete system: $24,000. The Bluebird line runs on the SuperDOS operating system that allows up to ten terminals to be linked to the PC; MS-DOS programs to be run concurrently.

∆ *Coins* is a program for coin collectors from **Compu-Quote** (6914 Berquist Avenue, Canoga Park, CA 91307; 213-348-3662). The software enables the serious numismatist to catalog an entire collection and obtain reports that serve for personal investment information. Contains 1,600 standard coin files, complete with descriptions and values. Generates four kinds of reports. $95. Demo: $10.

∆ A Corvus hard disk version of the *Datafax* file management system is available from **Link Systems** (1640 Nineteenth Street, Santa Monica, CA 90404; 213-453-8921). The software has the ability to cross-reference files one hundred different ways. $999.

∆ A software system for health care professionals, the *Capital Planning Model* from **Ernst & Whinney** (1550 Huntington Building, Cleveland, OH 44114; 216-861-5000) is designed to help executives prepare long-range capital plans. The package projects operating statistics and staffing requirements as well as salary, benefits, professional fees, and more. A project analysis component can address a multiple-phased construction project. Call for price.

∆ A p-System 8087 *Software Upgrade Kit*, which enables existing p-System application programs to take advantage of the floating-point

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processor's speed and arithmetic precision, is available from **SofTech Microsystems** (16885 West Bernardo Drive, San Diego, CA 92127; 619-451-1230). No data file conversion or recompilation necessary. $20.

Δ Create and modify library files that are compatible with the IBM PC-DOS linker using the *SR-Lib* utility from **Software Research** (Box 10004, Austin, TX 78766; 512-346-5097). Create your own libraries or add, delete, or replace modules in IBM compiler libraries. $29.95.

Δ **Insurance Technology Consultants** (1437 West Palmyra, Orange, CA 92668; 714-773-1754) announces *I.M.P.A.C.T.*, a calculation aid for reinsurance brokers or lead underwriters charged with the pricing of catastrophe treaties. $495. MS-DOS demo: $25.

Δ A directory of software for the IBM-PC is contained on two disks called *Diskonary* from **Execudisk** (Box 219002, Houston, TX 77218; 713-859-5178). The package features a routine that sorts the software titles by sixteen major and 106 minor categories. System requirements and software descriptions included. $34.95. Quarterly updates: $8.

Δ The **Wayne Green Publications Group** (Box 903, Farmingdale, NY 11637; 603-924-9471) has announced the spring 1984 publication of *jr*, a monthly magazine for PC*jr* users. The premiere issue will contain profiles and analyses of the features and capabilities of both versions of the Junior. Charter subscription, $14.97.

Δ **Microcom** (1400A Providence Highway, Norwood, MA 02602; 617-762-9310) has introduced an in-board communications system for the PC*jr*. Called *Era 2*, the system includes a 1200-baud modem and communications software and is provided with a four-year guarantee. $429.

Δ *Heroism in the Modern Age*, a complete role-playing system from **Pacific Infotech** (10850 Wilshire Boulevard, Los Angeles, CA 90024; 213-470-7590), lets the player live and experience the life of an alter ego in today's world. The game allows the player to create characters and guide them through their lives. $58.95.

Δ The first word processor ever developed for a microcomputer, *Electric Pencil* has been released for the PC by **IJG** (1953 West Eleventh Street, Upland, CA 91768; 714-946-5805). The program has been completely rewritten in 8088 machine language. $499.95.

Δ *Triple Brain Trust*, a question-and-answer game, is available from **Reston Publishing Company** (11480 Sunset Hills Road, Reston, VA 22090; 703-437-8900). Categories include word recognition, basic reading, geography, vocabulary, science, math, famous people and places, movies, football, baseball, and general sports trivia. $39.95.

Δ **Martin Marietta Data Systems** (6303 Ivy Lane, Greenbelt, MD 20770; 301-982-6670) has introduced a series of software packages. *KeepIT*, the central program in the series, is a relational database that allows users to move data or perform calculations based on a data file and use the results in any popular PC spreadsheet, graphic, or statistical analysis program. $450. Δ *CalcIT* is a three-dimensional spreadsheet calculation program with easy transfer of data to and from *KeepIT*. $400. Δ *LinkIT* is a PC-to-mainframe and PC-to-PC asynchronous communications program with full longitudinal error-checking. $150. Δ *PassIT* is a 3270-emulation program that can be used with IRMA and Forte boards for high-speed data transfer to a mainframe. $250. Δ *SortIT* is a sort/merge utility for DOS-based machines. $125. Δ *EditIT* is a full-screen editor with color windows and mouse management. $150.

Δ The *PC Bubble* board has been introduced by **Helix Laboratories** (16776 Bernardo Center Drive, San Diego, CA 92128; 619-451-0270). The half-megabyte board is designed to emulate a "mini-Winchester" and responds to fixed-disk commands under most operating systems. $1,495.

Δ **XQ Software** (4357 Park Drive, Norcross, GA 30093; 404-923-2880) offers tax and investment planning programs. *Tax Strategist* computes the federal income tax liability for up to ten years using tax tables, income averaging, or alternative minimum tax. $395. Δ *Investment Strategist* determines the economic value of tax-sheltered investments. Complicated investment situations can be analyzed to determine if the tax shelter is a good investment. $395.

Δ You can let the appropriate members of the U.S. Congress know what you think about certain issues with *File Clerk * Congress* from **Landrum Software** (Box 842, Palm City, FL 33490; 305-286-1324). Provides access to forty of the most important congressional committees and to each congressman's office address, telephone, home town, party, district, and reelection year. An annual update will be available. $33.95. 160K disk version, $44.95.

Δ A computer version of Chinese checkers is available from **MicroClassics** (315 West Grand Avenue, El Segundo, CA 90245; 213-322-6888). *Tiao Chi* offers problems of strategy for up to six human or computer players. $24.95.

Δ *Right:Justify* from **Engram Systems** (4820 Refugio Avenue, Carlsbad, CA 92008; 619-434-5956) justifies text created by the *PFS:Write* word processor. The program produces documents in *PFS:Write* format. $14.50.

Δ **Roland DG** (7200 Dominion Circle, Los Angeles, CA 90040; 213-685-5141) offers the *MB-122*, a monochrome monitor designed to be compatible with the PC monochrome display board. Features include nonglare screen, 2,000-character display, 720-by-150 resolution, and front panel brightness control. Green, $225. Amber, $240.

Δ A multifunction enhancement module for the PC and XT that facilitates memory expansion up to 640K and offers communications functions in a single chassis slot is the *Time Spectrum SB384* from **Persyst Products** (15801 Rockfield Boulevard, Irvine, CA 92714; 714-859-8871). The board allows PC users to add up to 384K of RAM to a PC already fully configured with 256K of memory. Also offered are socketed RAM, a calendar/clock with rechargeable battery backup, one asynchronous communication port, and a Centronics-or Dataproducts-compatible parallel printer port. From $395.

Δ *Staticide Wipes* from **ACL** (1960 East Devon Avenue, Elk Grove Village, IL 60007; 312-981-9212) are individually packaged towelettes for cleaning and static control. The wipes are saturated with Staticide concentrate, deionized water, and isopropyl alcohol, and can be used on any surface not adversely affected by water or alcohol. $4.98 per box of twenty-four.

Δ **Consumers Software** (Suite 106C-314, East Holly Street, Bellingham, WA 98225; 604-688-4548) announces *The Spreadsheet Auditor*, a program that audits *VisiCalc*, *1-2-3*, and *SuperCalc* spreadsheets. The formulas behind your spreadsheets are displayed in an easy-to-read grid. Requires 128K. $99.

Δ **Vista Computer Company** (1317 East Edinger, Santa Ana, CA 92705; 714-953-0523) offers the *DynaFrame*, an expansion chassis for the PC that contains a Winchester disk drive (from 5 to 140M), eight additional expansion slots, a front touch-panel display that allows monitoring of active banks of RAM, a reset function, and DiscLoc, a proprietary hardware function to write-protect the hard disk. From $2,449 to $9,995.

Δ **Visual Computer Incorporated** (135 Maple Street, Marlboro, MA 01752; 617-480-0000) has unveiled the *Commuter*, a sixteen-pound, sixteen-bit IBM-compatible personal computer. Standard features include 128K system memory resident on a single, multilayer PC board, expandable to 512K; MS-DOS operating system; 83-key keyboard; and double-sided, double-density 360K floppy-disk drive. From $1,995.

Δ **Whitesmiths** (97 Lowell Road, Concord, MA 01742; 617-369-8499) has developed a version of the Idris operating system for the PC that is designed to coexist with PC-DOS. $550.

Δ **Cdex Corporation** (5050 El Camino Real, Los Altos, CA 94022; 415-964-7600) has released two new tutorial programs designed to help a small business convert its manual general ledger to a computerized one. *Computerizing Your General Ledger using the State of the Art General Ledger Program* and *Computerizing Your General Ledger Using the Peachtree General Ledger Program* were developed with the assistance of Hemming and Morse, a CPA firm specializing in small-business accounting and consulting. $69.95 each.

Δ **Aardvark/McGraw-Hill** (1020 North Broadway Street, Milwaukee, WI 53202; 414-289-9988) announces the release of *Personal Tax Planner*, which is designed for home users who want to calculate and reduce personal federal income tax. The program figures short-term or long-term capital gain/losses, purchase or sale of real estate or other big-ticket items, second jobs, and business expenses. $99.

Δ *Bearings*, available from **Zephyr Services** (306 South Homewood Avenue, Pittsburgh, PA 15208; 412-247-5915), tells you which way to go. You specify your spot on the globe by entering your latitude and longitude. The computer calculates and prints out the distance and direction to more than five hundred other cities. $19.95.

Δ A software development utility for Fortran programmers that scans a single (and potentially large) program source-code file and creates individual source-code files of the main program and each subroutine, function, and block of data is available from **StratCom Systems** (1010 Turquoise Street, San Diego, CA 92109; 619-488-2262). *PC-Xtract* also creates an alphabetized batch file containing the name of each routine that has been extracted. Requires 87K. $49.

Δ **Award Software** (236 North Santa Cruz Avenue, Los Gatos, CA 95030; 408-287-9915) has developed *Crossave*, a solution to the problem of copying large files from a Winchester disk to floppy disks. The program can save and restore a file or selected group of files on the Winchester disk. It is available for both DOS 2.0 and CP/M-86. $99.

Δ *EMU*, a Data General Dasher terminal emulator for the PC and XT, is available from **Rhintek Incorporated** (Box 220, Columbia, MD 21045; 301-730-2575). The package consists of 100 percent assembly-language code that bypasses the DOS and BIOS calls to achieve 9600-baud terminal emulation. $95.

Δ If you are planning to take the Scholastic Aptitude Test, *Computer Preparation for the SAT* from **Harcourt Brace Jovanovich** (1250 Sixth Avenue, San Diego, CA 92101; 619-699-6335) will diagnose strengths and weaknesses in fifteen skill areas and then prioritize drills and review exercises to help you gain study efficiency. The computer scores automatically so students receive immediate feedback. $79.95.

Δ **Stoneware** (50 Belvedere Street, San Rafael, CA 94901; 415-454-6500) introduces *Advanced DB Master*, a business information management system. One file can span up to forty-four disks, with a capacity for sixteen million characters or the equivalent of four thousand pages of unique information storage. $595.

Δ With the *Practical UCSD Pascal Package* from **Network Consulting** (3700 Gilmore Way, Burnaby, British Columbia, Canada, V5G 4M1; 604-430-3466), users can learn to write Pascal programs. The kit combines the p-System and UCSD compiler with an implementation guide describing how to use the software and selected books that explain the p-System and Pascal. $295.

Δ **Edge Press** (119 South First Avenue, Arcadia, CA 91006;818-355-6769) has published *Profit from the IBM PC* by Dan W. Post. The book is designed to help PC enthusiasts recoup their investment by creating and selling free-lance services that meet the needs of special markets. $17.95.

Δ *Micro-DSS/Analysis* is a decision support analysis package from **Addison-Wesley Publishing Company** (Reading, MA 01867; 617-944-3700) that provides statistics, report writing, graphics, a database, and the ability to perform ad hoc analysis. $499.

Δ **Great Plains Software** (Box 9739, Fargo, ND 58109; 701-281-0550) has introduced *Rapid Transfer*, which will enable users of the company's *Harddisk* accounting series to transfer accounting data directly from *VisiCalc*, *1-2-3*, and *Multiplan*. Call for price. ▲

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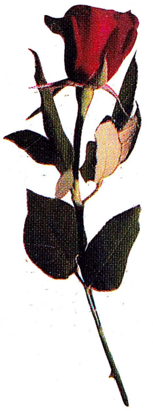

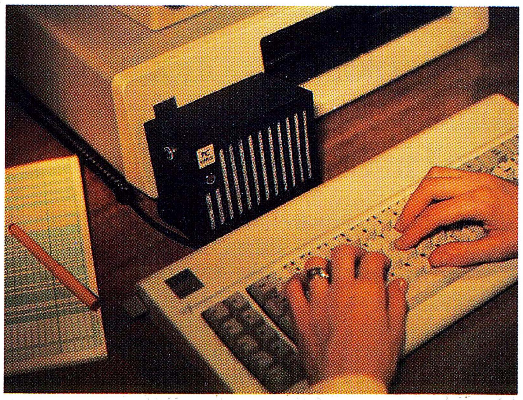

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MICRO FINANCE

by Ken Landis

Tax Preparer, by Howardsoft

Even now, perhaps, you're charging up your calculator, sharpening your pencil, and starting to palpitate. Rejoice, it's tax season, the federal government's Christmas; and the Internal Revenue Service and your local CPA are singing the carols!

Every year, millions of Americans call their friendly CPA, H&R Block, Big Eight accounting firm, or other tax professional to do their taxes. Many who do so have the inclination, but not the time or energy, to tackle their taxes alone. Maybe what keeps them from doing their taxes themselves is that they've let their records get out of control. Or maybe they just can't comprehend what went on in the "mind" of the IRS when it created all those forms, instructions, and regulations.

Tax preparation doesn't have to be overwhelming. And your PC can help you get out from underneath this annual migraine.

There are basically two types of tax software: tax preparation programs and tax-planning programs.

The first kind turns your computer into a powerful combination of filing cabinet, calculator, and accountant. You enter your tax data, and the computer stores it, manipulates it, and finally prints it out in a form suitable for filing with the Federales.

The other kind, tax-planning software, helps you analyze the tax effects of various transactions, such as selling stock, buying property, taking out a loan, and so on. Some prep programs let you do a certain amount of tax planning as well, but the opposite is seldom true.

In this article we'll review an example of the prep genre—HowardSoft's *Tax Preparer.* We'll prepare the tax return for Mr. and Mrs. Jonathan A. Sample, who live at 8822 Imaginary Road, Anytown, CA. This fictional couple comes to us courtesy of the HowardSoft documentation writers.

Federal income taxes and the laws that govern them change yearly. The tax preparation package that you could have used in 1982 to do your taxes can't be used in 1983. For that reason, HowardSoft publishes a yearly update to its program. *Tax Preparer* is designed so you can use the previous year's package to store your data and do preliminary tax planning; but when you're ready to start doing your taxes, you'll need to make sure you have the current version. Otherwise you'll be producing a 1983 return that's based on 1982 laws.

Before reading further, check the following list, which shows the forms and schedules *Tax Preparer* can handle; make sure the forms you need are included.

Form 1040—U.S. individual income tax return
Schedule A—itemized deductions
Schedule B—interest and dividend income
Schedule C—profit or (loss) from business or profession
Schedule D—capital gains or losses
Schedule E—supplemental income schedule
Schedule F—farm income and expenses
Schedule G—income averaging
Schedules R and RP—credit for the elderly

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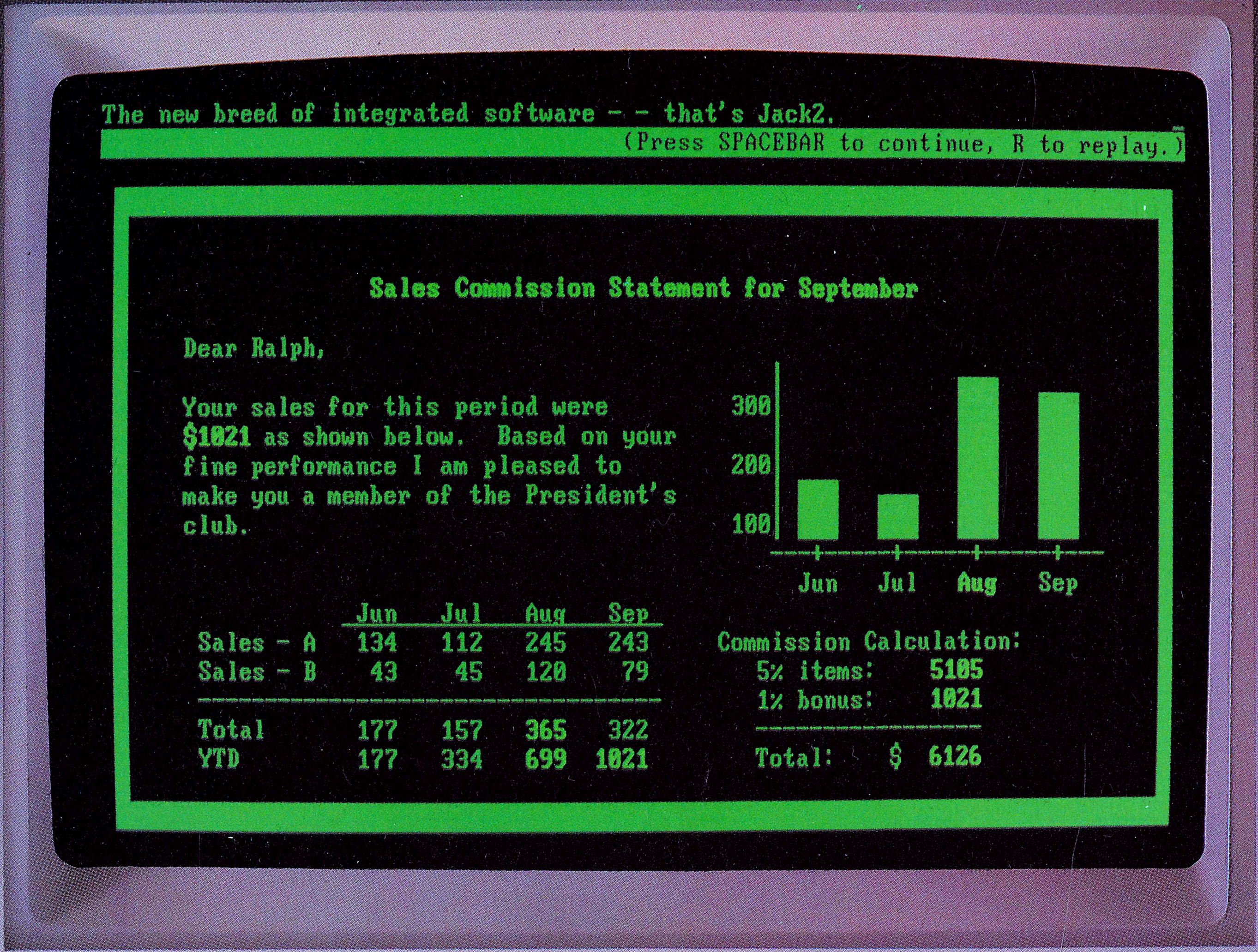

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                                                      Jun   Jul   Aug   Sep

                    Jun    Jul    Aug    Sep
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    Sales - B        43     45    120     79       5% items:     5105
    ---------------------------------------        1% bonus:     1021
    Total           177    157    365    322       ----------------------
    YTD             177    334    699   1021       Total:      $ 6126
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Schedule SE—Social Security self-employment tax
Schedule W—deduction for married couple when both work
Form 2106—employee business expenses
Form 2119—sale or exchange of principal residence
Form 2210—underpayment of estimated income tax
Form 2441—credit for child and dependent care expenses
Form 3468—computation of investment tax credit
Form 4562—depreciation and amortization
Form 4797—supplemental schedule of gains and losses
Form 5695—residential energy credits
Form 6251—alternative minimum tax computation

Tax Preparer prints schedules and forms in two ways. The IRS requires that any Form 1040 be reproduced on a preprinted form that fits IRS guidelines. This software will print Form 1040 information on one of many standard blank computer-printable 1040s. The names and addresses of blank-form suppliers are included in the documentation, along with one blank form. If necessary, taxpayers can adjust the Form 1040 printout format to fit their own forms, which may differ slightly from the IRS forms.

All other forms and schedules are printed out in a format that strictly follows the IRS guidelines for computer-generated returns. Not only does the IRS specify the format (as you would expect), it also specifies the size and types of paper you can use. The current set of regulations, including paper size and color, are listed in *Tax Preparer*'s documentation.

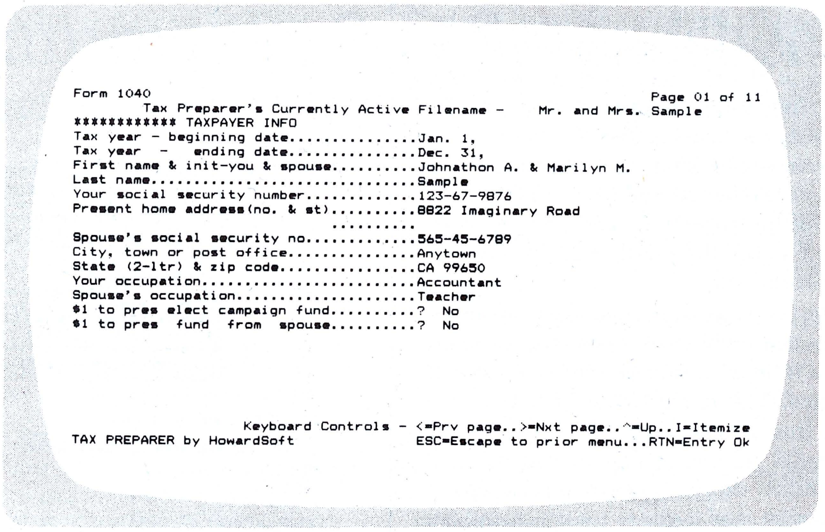
Before getting started on Mr. and Mrs. Sample's taxes, let's pause to read and ponder some good advice from the program documentation:

"The *Tax Preparer* by HowardSoft is a valuable computational aid but is not a substitute for thinking. It provides mechanical assistance in the mathematics and typing of returns—not legal advice. As a consequence, it provides the flexibility needed by tax professionals and prevents the uncontrolled posting of deductions to specific forms. It does, however, put responsibility on the user for making important decisions concerning tax deductions."

It's important to keep this advice in mind. The computer will do only what you tell it to. And if you tell it something wrong, you'll be the one who pays the price.

Now—on to the Samples' tax return.

Tax Preparer is completely menu-driven. To get to any part of the program, you simply work your way through the menu structure.



```
Form 1040                                                              Page 01 of 11
         Tax Preparer's Currently Active Filename -    Mr. and Mrs. Sample
************ TAXPAYER INFO
Tax year - beginning date...............Jan. 1,
Tax year  -   ending date...............Dec. 31,
First name & init-you & spouse..........Johnathon A. & Marilyn M.
Last name...............................Sample
Your social security number.............123-67-9876
Present home address(no. & st)..........8822 Imaginary Road
                                ..........
Spouse's social security no.............565-45-6789
City, town or post office...............Anytown
State (2-ltr) & zip code................CA 99650
Your occupation.........................Accountant
Spouse's occupation.....................Teacher
$1 to pres elect campaign fund..........?  No
$1 to pres  fund  from  spouse..........?  No



                     Keyboard Controls - <=Prv page..>=Nxt page..^=Up..I=Itemize
TAX PREPARER by HowardSoft                ESC=Escape to prior menu...RTN=Entry Ok
```

Figure 1

You can use *Tax Preparer* in either of two ways. If you're an experienced preparer, you can go directly to a form or schedule by way of the main menu. Less experienced users can use the program's built-in road-map feature. All forms and schedules can be accessed from within the program's Form 1040. This road map guides the novice tax preparer through the preparation process, rather than relying on his or her ability to read instructions and figure out which numbers go where. It's an excellent feature.

Figure 1 shows what the top of *Tax Preparer*'s Form 1040 screen looks like. The form is divided into eleven sections, or pages, of information, which are displayed one at a time

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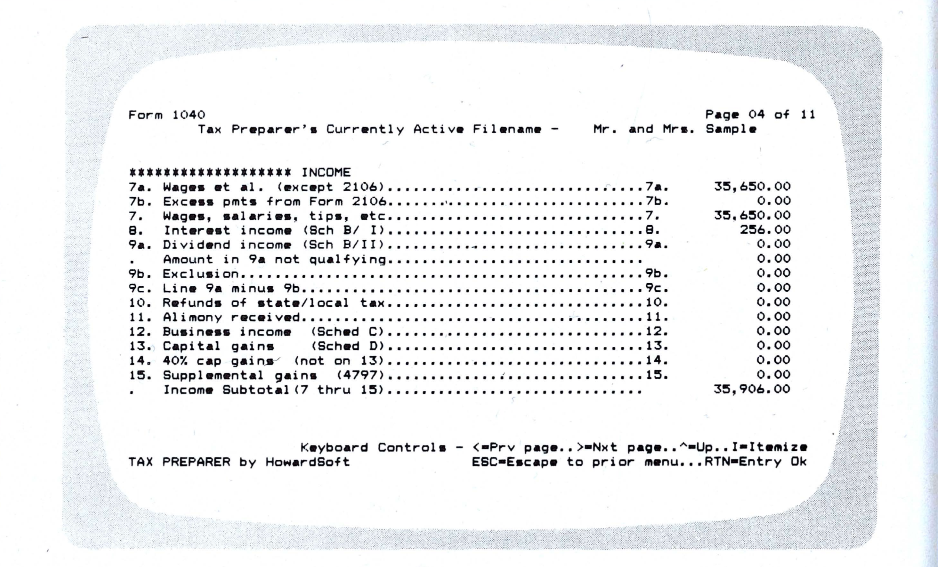

```
Form 1040                                                          Page 04 of 11
          Tax Preparer's Currently Active Filename -    Mr. and Mrs. Sample

******************** INCOME
7a. Wages et al. (except 2106)..............................7a.      35,650.00
7b. Excess pmts from Form 2106..............................7b.           0.00
7.  Wages, salaries, tips, etc..............................7.       35,650.00
8.  Interest income (Sch B/ I)..............................8.          256.00
9a. Dividend income (Sch B/II)..............................9a.           0.00
.   Amount in 9a not qualfying.............................               0.00
9b. Exclusion...............................................9b.           0.00
9c. Line 9a minus 9b........................................9c.           0.00
10. Refunds of state/local tax..............................10.           0.00
11. Alimony received........................................11.           0.00
12. Business income  (Sched C)..............................12.           0.00
13. Capital gains    (Sched D)..............................13.           0.00
14. 40% cap gains  (not on 13)..............................14.           0.00
15. Supplemental gains  (4797)..............................15.           0.00
.   Income Subtotal(7 thru 15).............................          35,906.00


                    Keyboard Controls - <=Prv page..>=Nxt page..^=Up..I=Itemize
TAX PREPARER by HowardSoft              ESC=Escape to prior menu...RTN=Entry Ok
```

Figure 2

on the PC screen. Just as you would if you were manually preparing your taxes, you begin in *Tax Preparer* by filling in the Form 1040, starting at the top and working your way down. Any form or schedule that can't be completely displayed on the PC's twenty-five-line screen will be divided into pages; the various pages can be accessed from a menu or by means of the page-down and page-up keys. Figure 2 shows the fourth page of *Tax Preparer*'s Form 1040.

After you enter a line item, the program either automatically starts calculating or waits for you to input a second return or a cursor command. The automatic calculation feature can be troublesome. Apparently because *Tax Preparer* is written in uncompiled Basic, it works rather slowly. It's easy to get ahead of the program, and if you're too quick and not sufficiently careful it's easy to get fouled up. The best way to use *Tax Preparer* is with much patience.

If you just enter the right numbers in the right places, *Tax Preparer* will take you straight through Form 1040, line by line, top to bottom. If that's all the program did, though, it wouldn't be worth a plug nickel.

The "grand structure" (the documentation author's phrase) doesn't become apparent until you're ready to enter information at a line item that is either computed on a separate form or is composed of more than one entry.

Let's consider line 7a from the Samples' Form 1040, which is shown in figure 2. The Samples' total wages are composed of Mr. Sample's $19,150 yearly income from his position as an accountant and his wife's annual teaching salary of $16,500. The Samples could store this information in a paper file, pull it out, add it up, and then enter it into *Tax Preparer,* or they could take advantage of the software's general itemizer feature.

If, at line 7a, the Samples input an *I*, rather than a number, the screen shown in figure 3 appears. This is one of *Tax Preparer*'s general itemizers.

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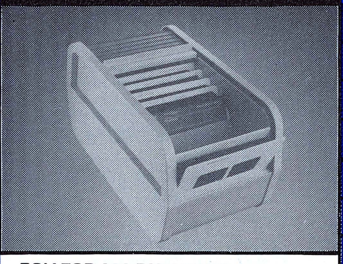
ORGANIZE & PROTECT



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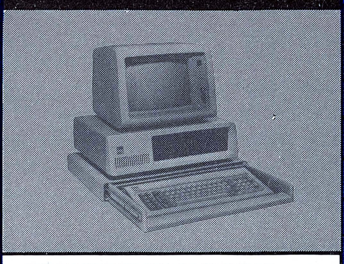

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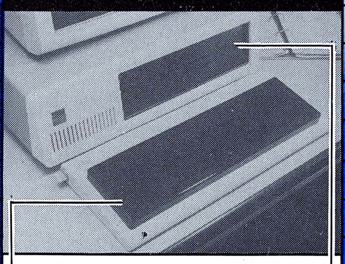

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A single keystroke lets the user move from page to page. The PgDn key brings successive pages to the screen; PgUp brings previous pages into view.

All program commands, functions and formulas are active throughout all pages. Alterations to a cell on any page are reflected on all pages where that cell has been referenced.

Report Manager also lets PC users view their spreadsheet data base two additional ways. The column view brings a specified column from each page to the screen. The row view brings one row from each page to the screen.

Report Manager includes its own built-in programming language, EXEC. Files built under EXEC can load automatically when the PC power is turned on, then prompt naive users for data entry. As Report Manager's application generator, EXEC allows persons with no special training or knowledge to use Report Manager productively. Typical applications include order entry, invoicing and billing.

The charts below show how Report Manager satisfies the professional's demand for multi-dimensional reporting power.

	3-D spreadsheet	Max. no. columns/file	Max. no. rows/file	Max. no. separate pages/file	Max. no. of cells ($\times 10^6$)	View crossection of cols.	View crossection of rows	Use up to 640K RAM	Built-in programming language	No. of program statements	Files request & receive data	Keystroke-playback files	Make your own menus	Chaining of files possible	Self-starting files	Auto. center of vert. headings	Auto. center of horiz. headings	No. graphing characters used	Printer configuration tables	Replicate (copy) option	Replicate in 3 dimensions	Replicate only cell format	Replicate only cell contents
Report Manager™	**Y**	**255**	**255**	**255**	**16.0**	**Y**	**Y**	**Y**	**Y**	**31**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**200+**	**Y**	**Y**	**Y**	**Y**	**Y**
Multiplan™	N	63	255	1	0.02	N	N	N	N	0	N	N	N	N	N	N	N	1	N	Y	N	N	N
1-2-3™	N	256	2048	1	0.50	N	N	N	Y	4	Y	N	Y	N	N	N	N	3	N	Y	N	N	N
VisiCalc™	N	63	254	1	0.02	N	N	N	N	0	N	N	N	N	N	N	N	1	N	Y	N	Y	Y
SuperCalc™	N	63	254	1	0.02	N	N	Y	N	0	N	Y	N	Y	N	N	N	1	Y	Y	N	N	Y

	Report linking (consolidation)	Top-of-column totals	On-line reference guide	Choose on/off coord. grid	Display formulas or their results	Repeat cell contents	Name cells in English	Write formulas in English	Variable, indiv. col. widths	Choose no. of decimal places	Titles available	Windows available	Choose auto. recalculation	Supports color or monochrome	XT compatible	Store reports in ASCII format	Read DIF™ files	Data link with Manager Series™	Copyable program included	Printed program tutorial	Data disk with examples	Usable templates included	Telephone support
Report Manager™	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**
Multiplan™	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	DNA	N	Y	Y	Y	Y
1-2-3™	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	DNA	N	Y	Y	N	Y
VisiCalc™	N	N	N	N	N	Y	N	N	Y	Y	Y	Y	Y	Y	N	Y	Y	DNA	N	Y	N	N	Y
SuperCalc™	Y	Y	Y	Y	Y	Y	N	N	Y	N	Y	Y	Y	Y	Y	Y	Y	DNA	Y	Y	Y	Y	Y

	Preprogrammed functions	No. of arithmetic operators	No. of relational operators	No. of trig. functions	Date + time arithmetic	Date interval in days	Day of week function	Linear regression	Look-up in 3 dimensions	Mode function	Time interval in seconds	Standard deviation	Trend line analysis	Radian/degree conversion	Amortization schedule	Effective interest rate	Future value for annuity due	Loan payment	Number of payments	Payment for annuity due	Present value	Present value for annuity due	Present value for a bond
Report Manager™	**68**	**6**	**6**	**6**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**
Multiplan™	41	6	6	4	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N
1-2-3™	51	5	6	7	N	N	N	N	N	N	N	Y	N	N	N	N	N	Y	N	N	Y	N	N
VisiCalc™	31	5	6	6	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SuperCalc™	36	5	6	6	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Y	N	N

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A general itemizer stores the details behind a line item, automatically sums the numbers, and then transfers the result into the line item from which it was called. The general itemizer's value is threefold. First, it acts as a filing cabinet, storing the information you need for your tax preparation. Second, the screens it generates can be printed out and used as supplemental schedules for tax filings. Third, the general itemizer automatically posts the results of its calculations to the right form or schedule.

Once the necessary information has been entered into the general itemizer, all the taxpayer has to do is press escape and *Tax Preparer* returns to the line item and posts the numbers from the itemizer.

General itemizers are used for line items that aren't computed on a form or schedule. Take another look at figure 2. Line 8 is interest income, which is computed on Schedule B. If the Samples were to press *I* at that line item, *Tax Preparer* would retrieve the input screen for Schedule B, not a general itemizer.

Figure 3 shows page 1 of the Schedule B screens from *Tax Preparer.* If the Samples wanted to use the general itemizer feature on any of Schedule B's line items, all they'd have to do is press *I* and they'd get a general itemizer.

For line items that involve calculations or for saving information that's more than a general itemizer can handle, *Tax Preparer* uses a special itemized list. A good example is the list used for capital gains (Schedule D lines 1f, 1g, 9f, and 9d), shown in figure 4. As you can see, the format, as well as the information stored and used within the list, is customized to the particular type of transaction. Each transaction takes up the entire display, but any number of transactions can be entered.

If at any point you want to do a calculation but prefer not to use the general-itemizer feature, you can use *Tax Preparer's* built-in calculator instead. This feature is activated any time you press the plus sign, minus sign, division key (slash), or multiplication key (asterisk). For example, if the Samples want to enter their income directly (not using the general itemizer), they can enter *16500+19500* and *Tax Preparer* will add the figures and record the sum. The major difference between the two methods is that the general itemizer stores the detail behind the result, while direct entry does not.

If you choose to go directly to forms and schedules, instead of availing yourself of the program's road-map option, you'll find the general itemizer and calculator features still available, but you won't have to work your way through Form 1040 to get where you're going.

Tax Preparer does not relieve you of the burden of determining which method of tax computation is appropriate for you. You have to make that choice yourself, just as you would if you were computing your return manually. You can choose to have your liability computed by way of the tax tables, tax rate schedules X, Y, Z, or Schedule G.

Once you've worked your way through Form 1040 and chosen which method of tax computation is right for you, you can flip to the last page of Form 1040 and see how much you owe (or how small your refund will be).

After you get up off the floor, you can simply press escape and *Tax Preparer* will send your data to disk under the name you entered at the top of Form 1040.

Tax Preparer can also be of some help with tax planning. To use the program for this purpose, you would create a pro forma tax return, which would represent your best guess at your financial posture; then you'd change the value of a line item you had control over, such as an expense or income item. You would instantly see the bottom-line result in your tax liability. Remember, though, that you have to know whether what you're contemplating is possible and legal. *Tax Preparer* is not a lawyer.

Once you have completed your return, your next step is to print it. Printing with *Tax*

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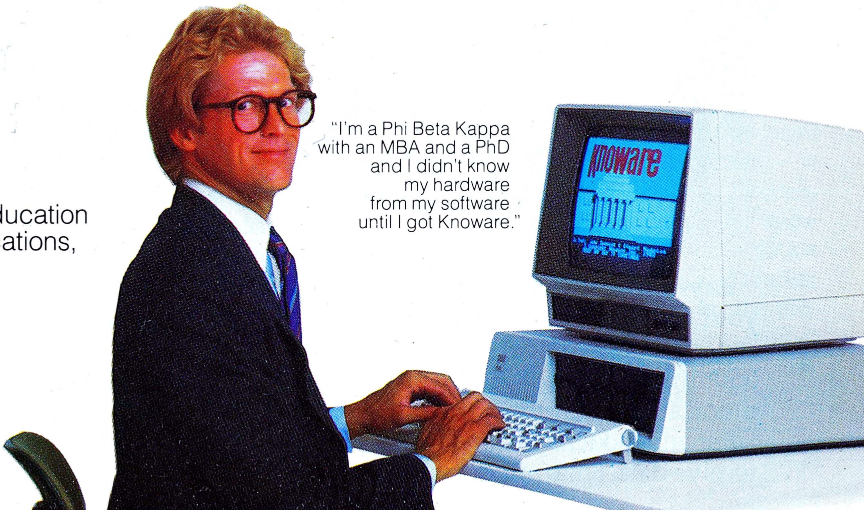

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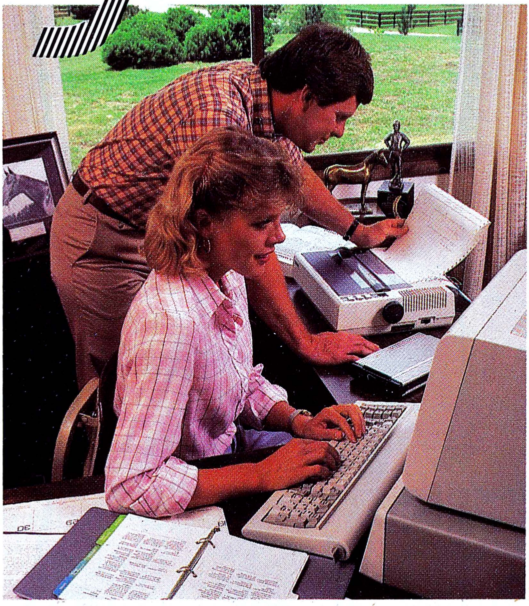
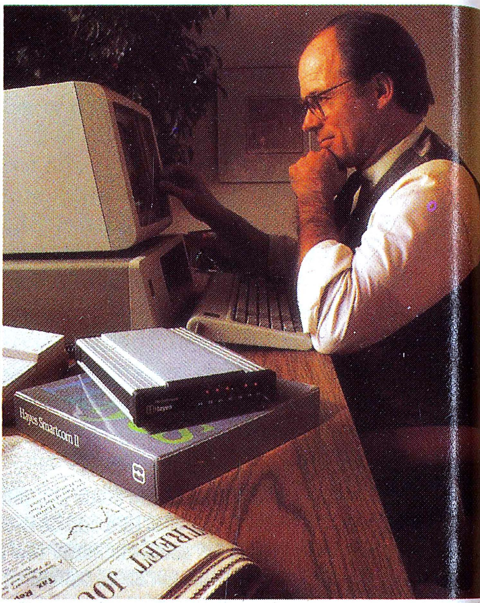


Gary: The pedigrees for next week's auction are as follows...



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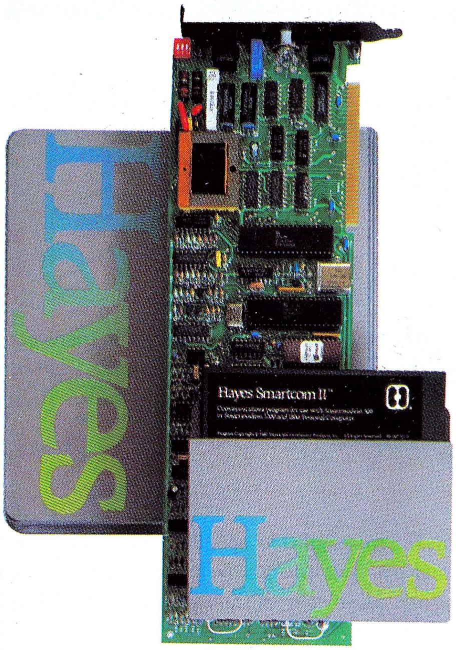

Smartcom II communications software.

NOTE: Smartmodem 1200B may also be installed in the IBM Personal Computer XT or the Expansion Unit. In those units, another board installed in the slot to the immediate right of the Smartmodem 1200B may not clear the modem; also, the brackets may not fit properly. If this occurs, the slot to the right of the modem should be left empty.

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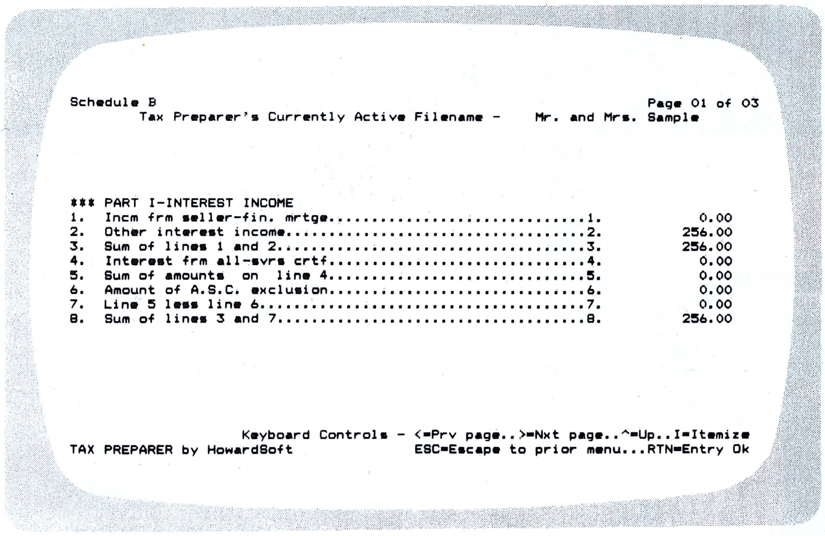
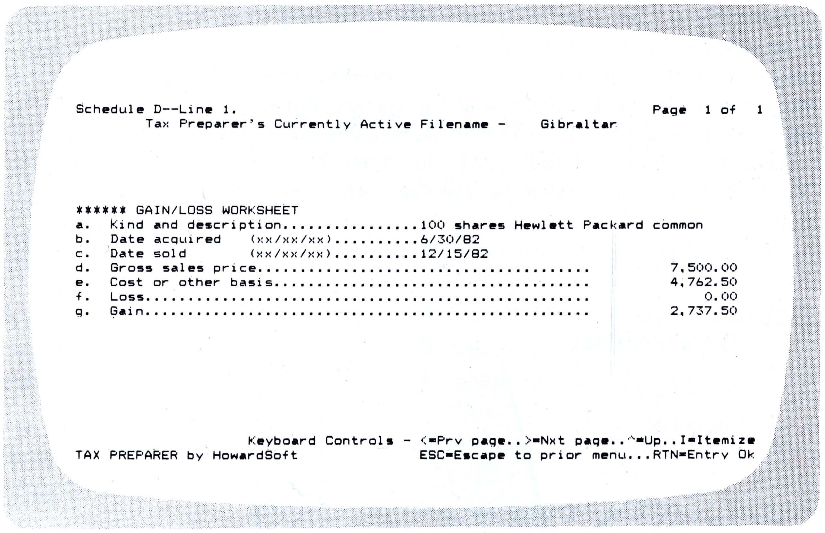


```
Schedule B                                                     Page 01 of 03
        Tax Preparer's Currently Active Filename -    Mr. and Mrs. Sample



*** PART I-INTEREST INCOME
1.   Incm frm seller-fin. mrtge..............................1.           0.00
2.   Other interest income...................................2.         256.00
3.   Sum of lines 1 and 2....................................3.         256.00
4.   Interest frm all-svrs crtf..............................4.           0.00
5.   Sum of amounts  on  line 4..............................5.           0.00
6.   Amount of A.S.C. exclusion..............................6.           0.00
7.   Line 5 less line 6......................................7.           0.00
8.   Sum of lines 3 and 7....................................8.         256.00



                     Keyboard Controls - <=Prv page..>=Nxt page..^=Up..I=Itemize
TAX PREPARER by HowardSoft                ESC=Escape to prior menu...RTN=Entry Ok
```

Figure 3



```
Schedule D--Line 1.                                           Page  1 of  1
        Tax Preparer's Currently Active Filename -    Gibraltar



****** GAIN/LOSS WORKSHEET
a.   Kind and description................100 shares Hewlett Packard common
b.   Date acquired    (xx/xx/xx)..........6/30/82
c.   Date sold        (xx/xx/xx)..........12/15/82
d.   Gross sales price.................................          7,500.00
e.   Cost or other basis...............................          4,762.50
f.   Loss..............................................              0.00
g.   Gain..............................................          2,737.50



                     Keyboard Controls - <=Prv page..>=Nxt page..^=Up..I=Itemize
TAX PREPARER by HowardSoft                ESC=Escape to prior menu...RTN=Entry Ok
```

Figure 4

Preparer is a fairly simple and straightforward matter. Little features such as page stops for single-sheet paper and alignment markings for preprinted forms indicate that the programmer has taken time to make the program as easy to use and functional as possible.

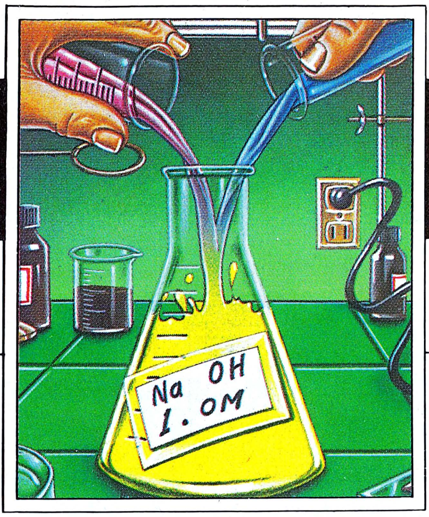
Tax Preparer has been designed to be suitable for individual taxpayers as well as commercial preparation services. The program is slow—perhaps too slow for some—but it has several features that will appeal to commercial tax preparers.

For example, the program can generate a standard summary letter outlining the present year's liability, amounts prepaid, penalties, and the amount owed. The bottom half of the summary letter is a bill for the preparation of the return. *Tax Preparer*'s preprogrammed printing sequence will automatically print the summary letter, Form 1040, facsimile forms and schedules, and supporting statements. All the preparer has to do is turn on the printer, start the sequence, and walk away.

Up to sixteen clients' returns can be stored on a single disk. *Tax Preparer* comes with a complete set of disk management utilities. When a disk's directory is displayed, *Tax Preparer* lists the disk's volume number, the name of each file (client), and the returns and schedules already prepared for each. The only shortcoming is the program's aforementioned lack of speed. But speed is a relative thing. To do what *Tax Preparer* does in five minutes might otherwise take a person an hour or more.

The editing features (insertion, deletion, and so on) work well and are clearly documented. As for *Tax Preparer*'s documentation in general, it's well written, clear, and concise. To supplement the documentation, the program includes a set of on-line help screens that cover program organization, operating tips, disk preparation and data storage. ▲

THE BASIC SOLUTION



by Joe Juhasz

Peeking, Poking, and Stalling

Peek and *poke* are two of the Basic programmer's most valuable tools. These statements allow you to access and modify any location in memory, including those locations that hold such system information as display adapter type, default disk drive, timer information, and so on. Skilled programmers can even use the *poke* statement to place short machine code subroutines in their programs or to store data in a more efficient way.

The next few installments of this column will present some of the many uses of *peek* and *poke*. If you know about worthwhile peeks and pokes that you'd like to share with other readers, please feel free to send them to The Basic Solution, Softalk/IBM, Box 7040, North Hollywood, CA 91605; we'll print some of the more interesting ones in subsequent columns.

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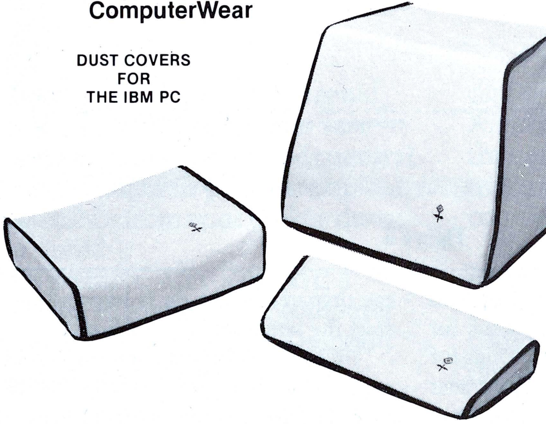

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Peek is a Basic function that returns the value of a byte in memory. The value is returned in decimal notation, and the location read can be anywhere in memory—including DOS and Basic's system information areas.

The syntax for *peek* is:

```
v = PEEK(n)
```

where *n*, an integer value in the range of 0 to 65535, is the offset from the memory segment defined by your program's most recent *def seg* statement. The retrieved value, an integer in the range of 0 to 255, is stored in the variable *v*.

Some useful settings for *def seg* include:

```
DEF SEG ' Basic's data segment
DEF SEG = 0 ' DOS's segment
DEF SEG = &HB000 ' Monochrome monitor display's
                   memory
DEF SEG = &HB800 ' Color/graphics display's memory
DEF SEG = &HF600 ' ROM Basic
DEF SEG = &HFE00 ' ROM BIOS
```

Poke is the complement to *peek*. It places a specified value into any byte in memory. The syntax is:

```
POKE n,v
```

where *n*, in the range of 0 to 65535, is the offset from the current memory segment and *v* is the data to be placed in the specified location. *V* must be in the range 0 to 255 or you'll get an illegal function call error.

Basic doesn't do any checking on the addresses to which you *poke*, and the IBM Basic manual advises against your changing values held in Basic's stack or variable areas or the area where your Basic program is stored. If you're just learning your way in Basic, it's probably best that you heed this warning. Later on, we'll show some creative and powerful ways to apply the *poke* statement to your program area.

Okay, now let's start putting *peek* and *poke* to use.

The following code is a simple way to determine which screen adapter cards (monochrome, color/graphics, or both) a system contains. The routine tests the assumption that an adapter card exists by placing a byte of information into the adapter's memory area, reading it back, and comparing the value read to the value placed. If the before and after values match, then the adapter card exists.

To test for the monochrome adapter, we set our *def seg* to &HB000, and to test for the color board we set the *def seg* to &HB800. We can *poke* into the same offset for both *def seg* settings.

```
DEF SEG=&HB000 ' Test for monochrome adapter
POKE 1,100 ' Place data
TEMP=PEEK(1) ' Get data
MONO.SW = (TEMP=100) ' If the same, then we have
                     ' monochrome adapter
```

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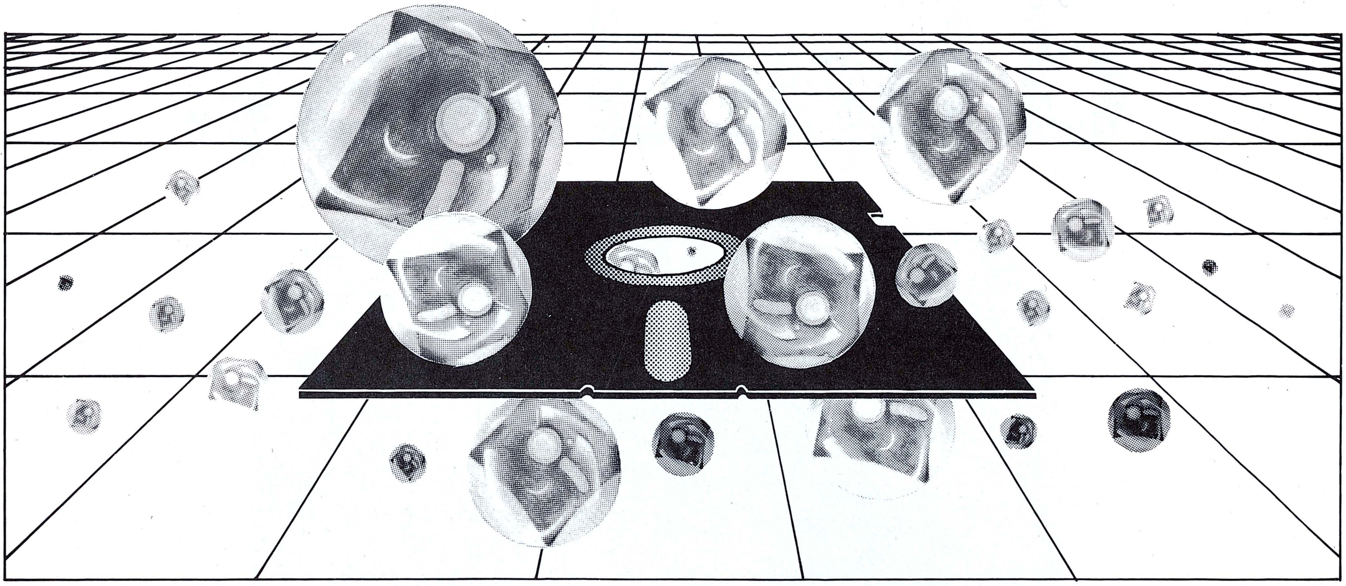

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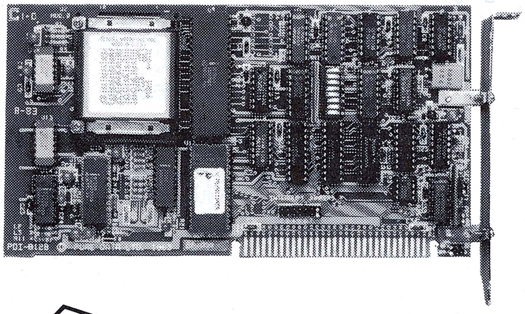

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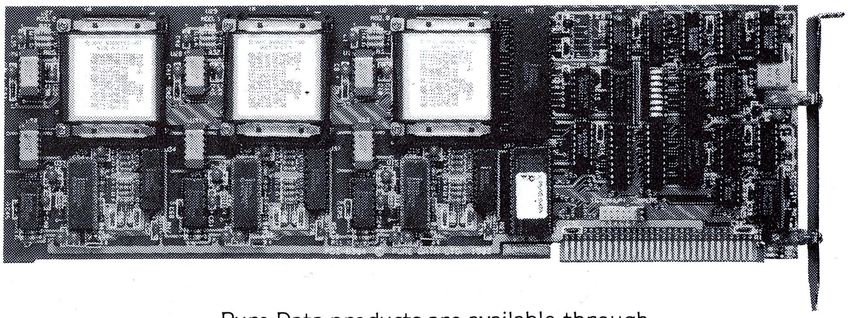

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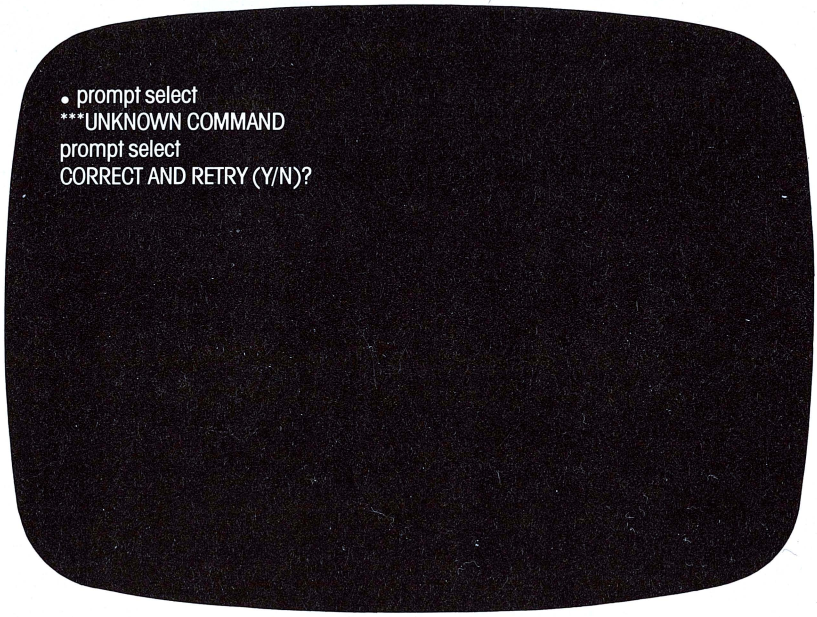
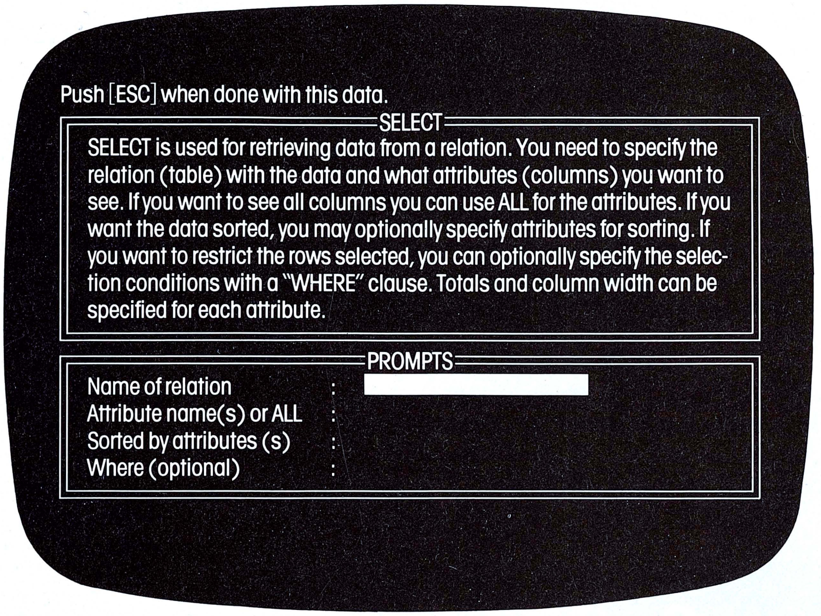


```
. prompt select
***UNKNOWN COMMAND
prompt select
CORRECT AND RETRY (Y/N)?
```

R way.



```
Push [ESC] when done with this data.
                              SELECT
SELECT is used for retrieving data from a relation. You need to specify the
relation (table) with the data and what attributes (columns) you want to
see. If you want to see all columns you can use ALL for the attributes. If you
want the data sorted, you may optionally specify attributes for sorting. If
you want to restrict the rows selected, you can optionally specify the selec-
tion conditions with a "WHERE" clause. Totals and column width can be
specified for each attribute.

                              PROMPTS
Name of relation           :
Attribute name(s) or ALL   :
Sorted by attributes (s)   :
Where (optional)           :
```

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```
DEF SEG=&HB800 ' Test for graphics adapter
POKE 1,100 ' Place data
TEMP=PEEK(1) ' Get data
GRAPHICS.SW = (TEMP=100) ' If the same, then we
                         ' have graphics adapter
DEF SEG ' It's best to reset segment to
        ' Basic's default segment
IF NOT MONO.SW THEN PRINT "NO ";
PRINT "Monochrome Adapter"
IF NOT GRAPHICS.SW THEN PRINT "NO ";
PRINT "Graphics Adapter"
```

Delaying Tactics. Occasionally, a program you're writing may need a slight delay or pause. A common technique is to use a small loop such as:

```
FOR PAUSE = 1 to 1000: NEXT
```

The pause loop can be lengthened or shortened to control the duration of the pause.

A major problem with this method is that you never know, without trial and error, how many loop iterations will be needed to effect the desired delay. The size of loop required will depend on such factors as the length of the program, the position of the loop within the program, the presence or absence of event-trapping statements such as *key(xx) on*, and so on. And if you're not certain whether or not your user will be compiling your program, there's no way you can use a simple pause loop to get the right delay; a five-second delay in an interpreted program would be barely noticeable in a compiled program.

A second means of creating pauses in Basic is the *sound* statement, which lets you generate pitches of specified frequency for specified lengths of time.

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For example: *sound 200,18* generates a 200 Hz pitch lasting for eighteen machine clock ticks. The PC clock ticks 18.2 times per second (see the discussion of *sound* in the Basic manual), so the tone produced by *sound 200,18* will last just less than a second.

Execution of a program containing a *sound* statement continues while the tone is generated until another *sound* statement appears. At this point, the program stops until the tone created by the prior *sound* statement has achieved its appointed duration. This fact—and the fact that the human ear can hear only a limited range of frequencies—forms the basis for a more exact method of creating delays.

The statements *sound 32767,18.2 *Secs! : sound 32676,1* will cause a delay of Secs! seconds. The delay will be the same in interpretive Basic as in compiled Basic.

You'll notice a clicking sound if you use this technique. The fact that this clicking is distracting motivates us to look for a still better pause-making algorithm.

Basic's system variable Time$ returns the current system time. A small routine can be written to test Time$ repeatedly until the desired delay is achieved. This delay would be silent, and its duration would be the same under any version of Basic, but its accuracy—to plus or minus one second—would be insufficient for most applications.

Since the clock ticks 18.2 times per second, you might assume there's a better way. In fact there is.

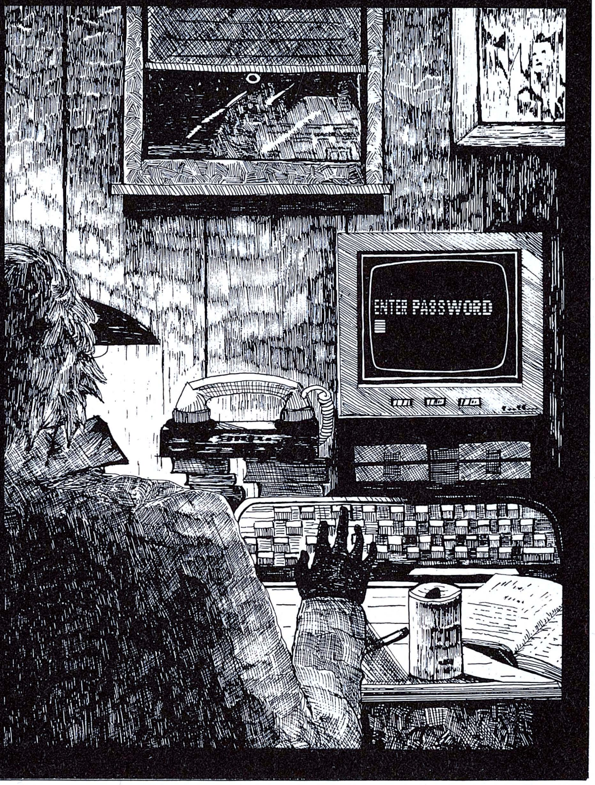
DOS keeps track of time by counting clock ticks and recording them at address 0000:046C through 0000:046F. The following code generates a pause by peeking at the tick counter. With a little ingenuity, you can use this technique to accurately determine the execution times for parts of your programs—as well as for controlling delay loops.

```
100 DEFINT A-Z: CLS ' a standard opening statement
110 '
120 '****************************************
130 '***  DEFINE FUNCTIONS used to determine number of clock ticks ***
140 '***  and seconds currently stored by DOS. The count of clock   ***
150 '***  ticks is stored at addresses 0000:046C thru 0000:046E.    ***
160 '***                                                           ***
170 '***  You must set the segment to point to segment 0 prior to  ***
180 '***  calling either function. It's also a good habit to       ***
190 '***  reset the segment to Basic's default after calling the   ***
200 '***  functions.                                                ***
210 '***       DEF SEG=0 will set the segment to 0                 ***
220 '***       DEF SEG will reset the segment to Basic's default   ***
230 '***                                                           ***
240 '***  FNTICKS! is a function that returns the count of clock   ***
250 '***       ticks stored at 0000:046C thru 0000:046E.           ***
260 '***                                                           ***
270 '***  FNSECONDS! is a function that converts the number of     ***
280 '***       clock ticks stored at 0000:046C thru 0000:046E      ***
290 '***       into a number of seconds.                           ***
300 '****************************************
310 '
320  DEF FNTICKS! = PEEK(&H46C)+PEEK(&H46D)*256+PEEK(&H46E)*65536!
330  DEF FNSECONDS! = (FNTICKS!/18.2+.5)
340 '
350 '
360 '
370 '***—test pause—***
380          INPUT "Enter number of seconds to pause: "; PAUSE!
390          GOSUB 430 ' go to pause.
400          BEEP
410 GOTO 370
420 '
430 '***—pause for pause! seconds—***
440          DEF SEG=0 ' set segment register to 0.
450          DONE!=FNSECONDS!+PAUSE! ' calculate time when pause should
460                                  ' be finished.
470          IF FNSECONDS!<DONE! GOTO 470 ' wait till we are done.
480          DEF SEG ' set segment register to Basic's default.
490 RETURN
```

Next month's "Basic Solution" column will include a list of some useful *poke* and *peek* addresses—and some more program segments to put them to use. ▲

NEWSPEAK

Computer Crime
Mining Mainframes
Arty Robots
...and more!



LA AUTHORITIES MOVE TO CURB CRIMINAL COMPUTING

In November of last year, nineteen-year-old UCLA student Ronald Mark Austin attracted considerable media attention when he was arrested and charged with fourteen counts of maliciously accessing a computer system. Working out of his Santa Monica, California, apartment on a personal computer, Austin "broke into" a U.S. Department of Defense communications system and tapped into fourteen research agencies, including the Naval Research Laboratory in Washington, D.C., the Norwegian Telecommunication Administration, the Computer Science Network in Wisconsin, the Mitre Corporation in Massachusetts, and a system at Cornell University.

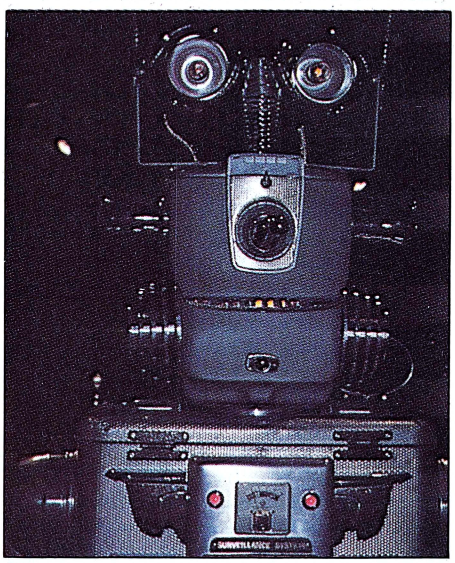
Austin's modus operandi bore some resemblance to that of the teenage "hackers" who have also been an object of media attention in recent years. But when they arrested Austin at his apartment, officials found evidence indicating he may have been involved in more than just whiz-kid antics.

Whatever the case may have been, Austin's actions have worried local law enforcement agencies. Computer crime is not new, but the rate at which such crime is occurring

GOTO page 163, column 1

Whimsical Art Show Features Playful Robots

Late last year, a bizarre combination of metal sculpture and photographs was displayed at the Chevron Art Gallery in San Francisco. Featuring the talents of sculptor Clayton Bailey and photographer Ken Botto, the show, called Robot Realities, presented a satirical view of mechanical beings. Using various metal objects and rolled aluminum, Bailey constructed whimsical versions of robot companions, servants, secretaries, sentries, and household pets—creatures that seem to have sprung from the golden age of science fiction or from the pages of Isaac Asimov's robot novels.



"There are reincarnations of household appliances," states Bailey. "My robots are personable, not at all like the industrial robots currently used in factories."

Ken Botto's photographs portray fabricated situations. He has placed intricate toy robots in elaborate other-worldly settings or in familiar domestic ones. Author of *Past Joys* (Chronicle Publications), a pictorial essay on old toys, Botto has researched the robot phenomenon, which started in the 1920s.

"The Japanese became robot-conscious right after World War II when they exported a toy robot called Atomic Robot Man to this country. The toy world has accepted the robot concept for quite some time."

Botto's photos present a more threatening picture of robotics, which he attributes to the western world's representation of robots as

GOTO page 164, column 2

Chicago Firm Helps Companies Cash In on Obsolete Computers

As newer, smaller, more powerful computers continue to appear on the scene, many of their larger, less powerful forebears have begun to disappear. The ability of the micros to outcompute the once-mighty mainframe is not the only reason they are vanishing.

There was a time when many mainframe and minicomputers were made with silver, platinum, and copper. Gold, an excellent electrical conductor that once cost a mere $40 an ounce, was also used in large quantities. About ten years ago, when the price of gold was allowed to rise, computer manufacturers started using palladium instead.

The current price of gold is good news to some owners of older mainframes—machines that may have otherwise become negative assets. In the past, old systems with original costs in six figures have gone to new owners for a few thousand—or have gone straight to the dump. Some older computers are moldering in storage, their owners paying in the hundreds of dollars per month for the privilege.

About a year ago, Forsythe Computer Associates, a Chicago-based computer leasing company, began a dismantling service that strips older machines of their precious metals. Now these old computers, destined for extinction, are disappearing even faster. Forsythe's dismantling plant processes about two hundred machines a month.

Plant manager Joe Zabelle draws a comparison: "It's like killing dinosaurs," he says. "When all the dinosaurs are gone, our work will be done." Zabelle reckons that time will be some two to five years from now.

Forsythe charges customers $1.50 per pound to process an old machine, in addition to a 15 percent commission on the value of the metals extracted. Companies such as IBM, Honeywell, and Burroughs have inhouse facilities for extracting precious metals from computers, but Forsythe is currently the only company that processes machines for ordinary folk.

Most of the precious metals, found in contact points, chips, and electronic circuits, are extracted from the guts of the computer. The precious metal scrap is first burned to remove impurities and then smelted into a copperbase metal. The result is a bullion bar composed of the precious metals, which are later separated. The whole process takes about sixty days.

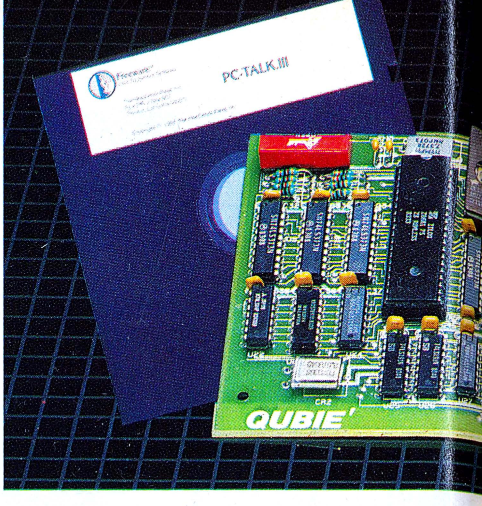
When it comes to these old machines, things are not always as they seem, says Zabelle. "There might be two identical models, just one serial number apart, but one may be worth two thousand dollars more than the other. From time to time, we even get some that are worth nothing." Still, a large computer can be worth as much as twenty-two thousand dollars, and, according to Zabelle, looking for the wealth is half the fun.

"We have a great time using saws and sledgehammers. One employee has even kidded about using dynamite," says Zabelle. They haven't gone that far yet.

"The work is a little noisy but very relaxing," boasts Zabelle. "We don't have any frustrated employees."

Most of the plant's employees are "guys who like to see how things work," he adds. There are a few computer programmers, however, hammering away with the rest. Some people never get tired of making systems crash.

MS



Flip the pages. You see PC modem cards with fewer features advertised for as much as $599. Up until now that's how much it cost to make a modem capable of transmitting at 120 characters per second (1200 baud). It doesn't take a computer to figure out the savings in phone line charges when you communicate four times faster than the 30 character per second modems (300 baud). Now you can have the solution to your communication needs at an affordable price.

SEE HOW THEY WORK

You can image how precise the components have to be to convert tones over a phone line into 120 characters every second. Precision equates to cost. With the advent of the mass market in personal computers the economies of scale drove the costs of manufacture down, but did not effect the precision required. The technology used is called "analog filtering". It is the process of sending (modulating) and receiving (demodulating) tones with perfect pitch. A lot of adjusting, noise suppression, and a little magic is required. Real expensive. Some use lots of chips and filters (known as discrete components). The latest rage is LSI (Large Scale Integration) technology. Which is the same old analog stuff condensed onto fewer chips.

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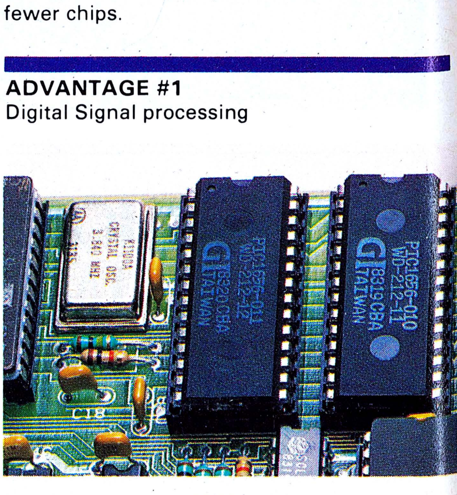
Digital Signal processing



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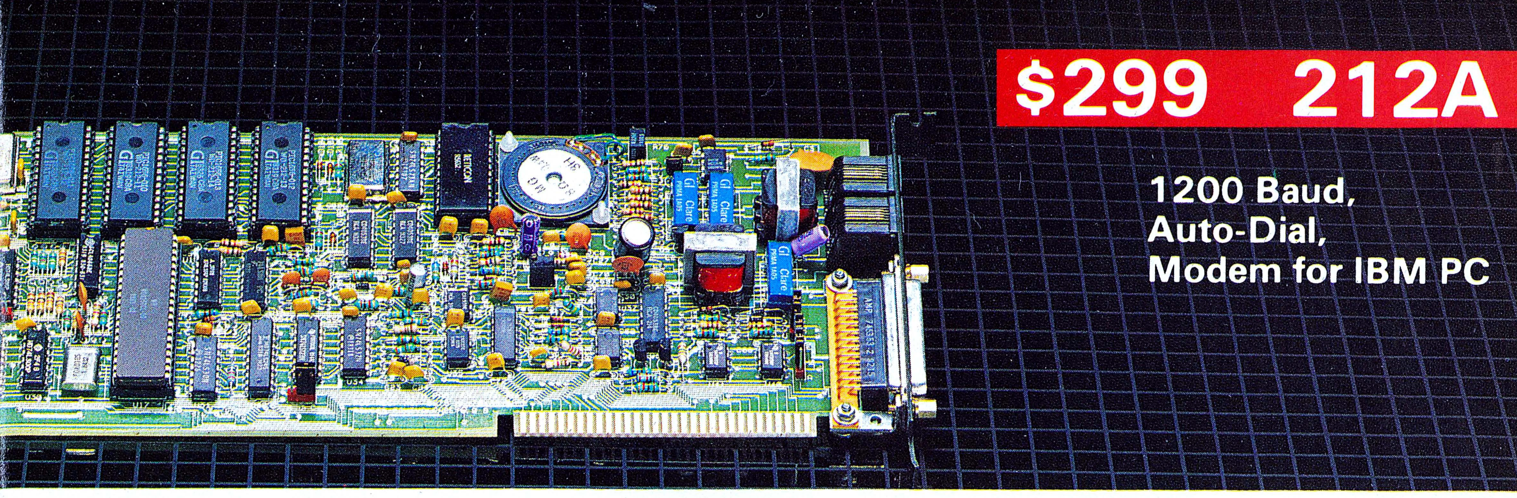

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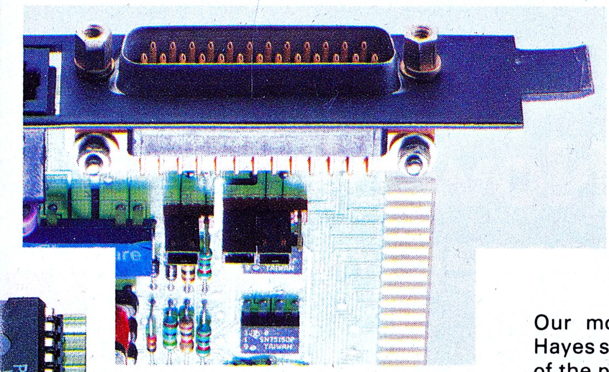

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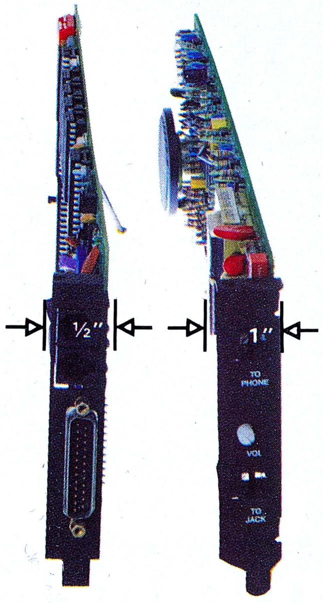
ADVANTAGE #3

Just one slot in PC or XT



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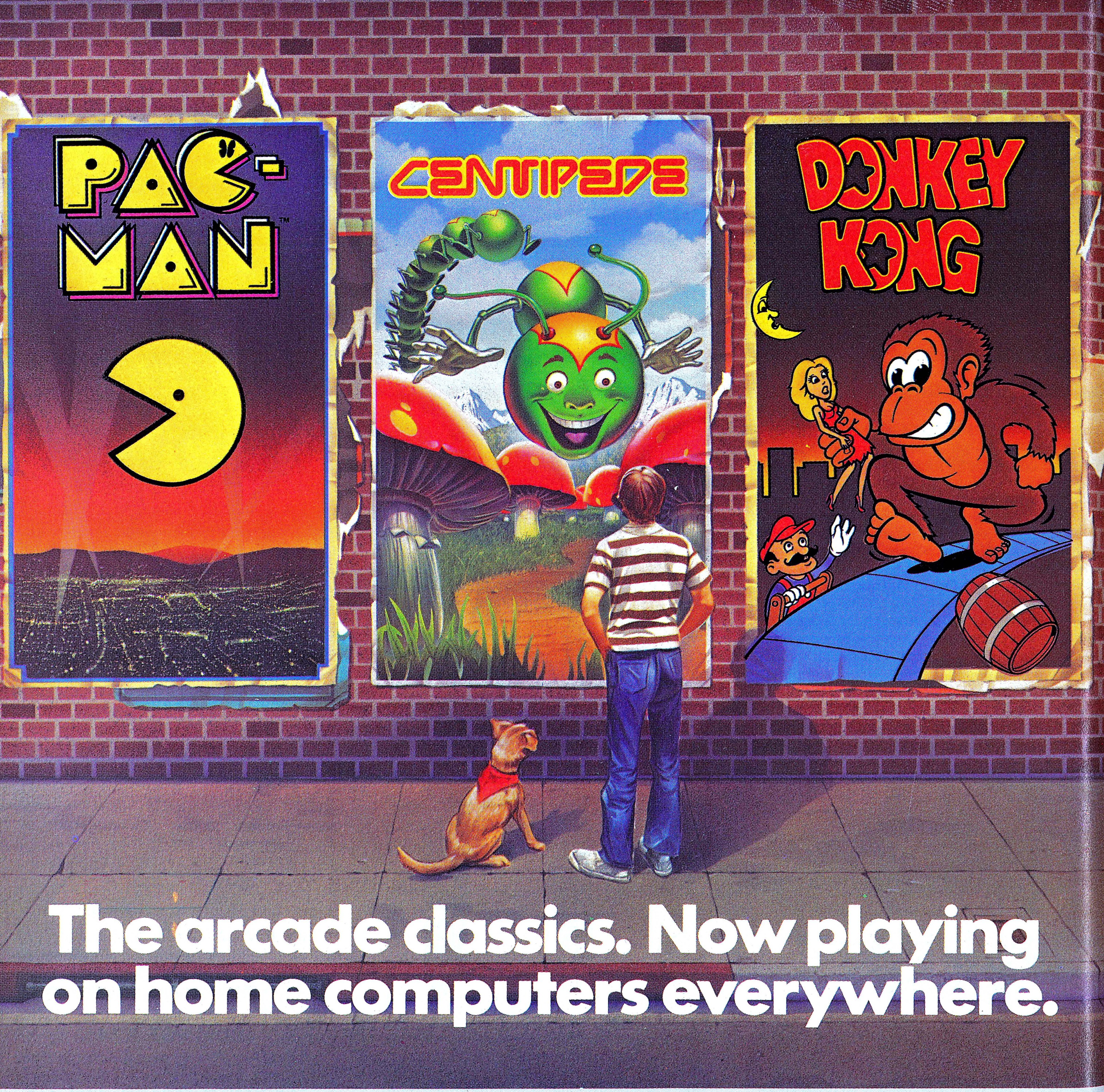

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Criminal Computing

continued from page 159

is rising dramatically. In response to Austin's arrest and in recognition of the problem in general, Los Angeles District Attorney Robert Philibosian instigated the formation of the Electronic Crime Task Force. The task force's mandate is to investigate computer crimes and prosecute computer criminals.

In 1979, Deputy District Attorney Clifton Garrott was the only full-time employee of the electronic crime section of the D.A.'s major fraud division. The new task force includes Garrott, Deputy District Attorney Kim Wildman, Investigator Duane Trump, and twelve part-time investigators (who are undergoing training). According to Philibosian, the task force was formed not only to punish computer criminals but also to augment the public's awareness of computer crime.

"When you have as technical an issue as computer crime, and all the subissues, and you're trying to explain it all to a judge or jury, a certain amount of technical knowledge on the part of the prosecutor and investigator is required," says Philibosian. This knowledge is needed not just to prepare the case for trial but also to explain it adequately to a group of lay people.

"The other reason for the force," says Philibosian, "is to attract attention to this area so that people who are victims will know they have a place to go to make a complaint and won't just throw up their hands. We also want to convey to potential computer criminals that they're going to be detected, arrested, and convicted. They're going to be punished. By conveying that in advance, we hope to deter them."

Philibosian declined to reveal the methods used by the task force in detecting computer crime, saying only that the force "cooperates with agencies that have computers" and works through these agencies' technical people.

According to Philibosian, the Electronic Crime Task Force investigates various categories of computer thieves, ranging from stereotypic adolescent computer geniuses to thrill-seekers to planters of logic bombs.

"A person such as Austin, for example, is referred to as a computer hacker, one who invades computer programs and causes damage by preventing people from getting into the system, destroying programs, or removing information in an unauthorized way. It would be just as if they were to back up a moving van to a computer store and take out $500,000 worth of hardware."

Unlike computer hackers who seek simple thrills, other computer criminals are breaking into computers for financial gain and revenge on their employers.

"Some people commit fraud by computer, transferring money from one account to another," Philibosian explains. "This is the type of person who before we had computers committed fraud by altering accounts. Usually, these are people within financial institutions. Another type of computer criminal is one who is stealing information to use for some kind of fraud."

An example of this last type of computer crime was recently investigated by the task force. The case involved a former deputy sheriff who posed as a member of the police force in order to obtain computer information and sell it to his current employer, a private investigation agency.

"Another person is the destructive type of criminal," Philibosian continues, "who, because he has a grudge against a particular company, wants to destroy the company's computer program. That's done by planting a logic bomb—a collection of destructive commands—that wipes out information. Still other people extort money from a company by threatening to blow up information if they are not paid a certain amount."

An example of the extortion/blowup variety occurred last July when two individuals tried to sabotage the computer system at Collins Food International, the company that provides payroll and inventory services for Kentucky Fried Chicken and Sizzler franchises nationwide. The logic bombs planted by the two employees, both Los Angeles computer programmers, would have deleted inventory and payroll information, shut down the computer system, and then erased the signs of intrusion to protect the pair.

Another computer manipulation technique is known as the "Trojan Horse." The perpetrators of this kind of computer crime arrange matters so that a legitimate user of a system unknowingly sends information to a person who isn't entitled to it.

"Then, of course," says Philibosian, "there's the straight theft of computer time—someone who runs programs for his own purposes on someone else's computer."

The penalties computer criminals face vary from state to state. As of August 1983, twenty states had legislation specifically penalizing computer criminals. California Penal Code Section 502 specifies a penalty of three years in state prison, a year in county jail, or a fine of up to $5,000 for a variety of computer crimes. Hearings held later this year will determine what sort of federal legislation will cover computer crime.

GOTO page 164, column 2

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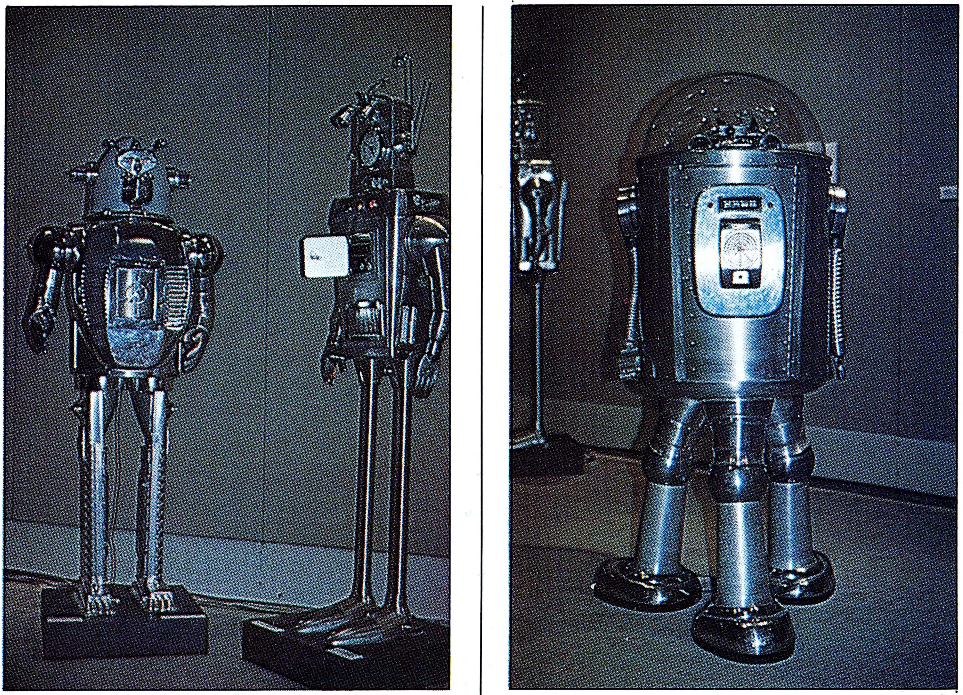

Left, two of Clayton Bailey's creations, Ape Guardian and Smoke Ring Blowing Grandfather Clock; right, Bailey's robots are made of aluminum, household objects, and other fanciful materials.

Robots

continued from page 159

evil. From the publication of *Frankenstein* on, the creation of any living thing, mechanical or not, has been seen by some as an unholy attempt to imitate God. And in science fiction literature and films, robots are often portrayed as inhuman and vicious killers.

Botto's photographs have appeared in galleries at the University of Arizona at Phoenix and at the Trans America Building in Los Angeles. His two-dimensional treatment of robots adds flavor to the three-dimensional aspect of Bailey's life-sized works.

For the last several years, Bailey—formerly a ceramic sculptor—has constructed whimsical robots. He has put together *The Robot Builder's Manual*, a twenty-eight-page booklet that contains complete instructions for building various mechanical beings out of available materials.

According to Linda Evans, president of Art Programs Incorporated (sponsor of Robot Realities), the show is quite appealing to kids. "More than twenty-six hundred students have visited the Chevron Gallery," she says. "Robot Realities has been a tremendous success." HL

Criminal Computing

continued from page 163

Philibosian says that while the laws in California are strong in terms of computer theft (which is covered by normal theft laws and by Section 502), more awareness in the areas of prevention and security is needed to counteract the knowledgeable computer thief.

"Passwords, for example, and access to those passwords, must become more complicated," Philibosian maintains. "The use of more complex passwords with more letters would be one way of preventing entries because it would be difficult for a criminal to come up with a password by random methods."

Even though he has formed this task force and although he stresses the need for enhanced societal awareness of computer crime, Philibosian does not believe that computer crime is becoming more common than other varieties of crime. "We have crime all over," he says. "We still have cattle rustlers, right here in Los Angeles County. Computer crime is just a new way to steal. We have relatively few computer criminals because relatively few people have that kind of capability and knowledge." JG

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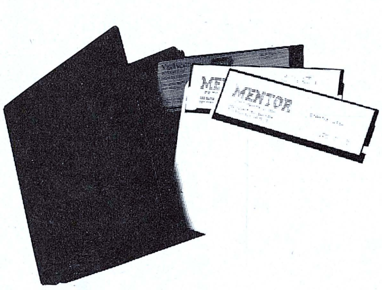

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Δ **Silicon Reds.** This past November, the State Department placed Silicon Valley, the high-technology industrial area south of San Francisco, officially off limits to Soviet diplomats. Restrictions designating areas of the country as open or closed have been in existence in various forms since 1951; they're imposed solely because the Soviet Union puts similar limits on the freedom of movement of American personnel in the U.S.S.R. Currently, closed areas in the United States include most of the centers of the defense industry, including the Silicon Valley, eastern Long Island, Seattle/Tacoma, and large parts of southern California and Texas. The State Department's action makes it official; but, in practice, Soviet requests to visit Silicon Valley have been denied for several years. The regulations include no specific machinery for enforcement or penalties if they're violated. Any infringements are handled as diplomatic incidents on a case-by-case basis.

Δ **Workers Vote Nonunion.** In a landslide vote last November, employees of Milpitas, California-based Atari chose not to join the Glaziers, Architectural Metal and Glass Works Union. The outcome of the vote was not a surprise; unions have had a tough time getting even a foothold in Silicon Valley industries. A study conducted by the American Electronics Association found that unions won only seven of thirty-seven bids to represent workers at high-tech firms between 1977 and 1982. Nonetheless, because Atari had laid off seventeen hundred workers last February, labor leaders were hopeful about this vote. The talley—143 votes against unionization and only 29 in favor—is seen as indicating that the unions will never have much impact in the valley. When asked about the vote, several workers expressed the opinion that unions are not much help. Though crushed for the moment, the unions are saying the battle isn't over yet. The union can come back again and probably will—perhaps with a new image designed to be more accessible to young workers who aren't sure about unions.

Δ **Tottling Turtle.** Harvard Associates (Somerville, MA) has announced a new robot teaching device—the Turtle Tot. Manufactured in Australia by Flexible Systems (Hobart, Tasmania), Turtle Tot is a simpler, smaller version of the Tasman Turtle, which Harvard Associates distributes in the U.S. for Flexible Systems. Priced at around three hundred dollars, Turtle Tot can be programmed by various microcomputers through an RS-232 interface. Turtle Tot can move, draw, turn, blink its "eyes," and feel its surroundings with touch sensors. An optional speech package is available as well. Turtle Tot is intended for use in classrooms, including preschool classrooms.

Δ **Black Gold Conference.** A new exhibition and conference, Electronics in Oil & Gas/U.S., will take place June 4-7 at the Convention Center in Dallas, Texas. The conference will focus on the key role of electronic equipment and technology as applied to the petroleum and gas industry and will be held in tandem with the World Oil & Gas Show and Conference. Electronics in Oil & Gas/U.S. will concentrate on electronics technology as it applies to processing, production, supervision, data control, communications, navigation, testing, instrumentation, safety, and other operational functions. Information about both shows may be obtained from Martin C. Dwyer International (a Cahners Exposition Group company based in Des Plaines, Illinois).

Δ **City of a Thousand Bar Codes.** Paris, France, has been selected as the site for the National Retail Merchants Association's World Retailer's Business & Equipment Exposition. Scheduled for April 8-11 at the Palais des Congres, the exposition will feature exhibits ranging from the most sophisticated electronic and telecommunications technologies to the most efficient and creative store planning and sales promotion. For additional information, contact NRMA's office in New York City.

Δ **Robot Wares.** At first, recession-weary workers in Michigan's auto industry feared and opposed the coming of robots and automation. Their catch phrase was "Robots don't buy cars." Now, however, the attitude is different. Workers and manufacturers are both placing high hopes on the growing robotics industry. There are more than thirty robotics companies in the state of Michigan, with many more on the way. Experts predict that robotics and automation could become a $25 billion business in the United States by the end of the decade. Michigan seems to be in a good position to grab much of this business because it has a strong university system and an industrial structure for a high-tech industry already in place. There is also a new entrepreneurial spirit evident on the state's campuses and in local companies. ▲

Editor **David Hunter**
Contributors **Jane Greenstein, Hartley Lesser, Marsha Stewart**

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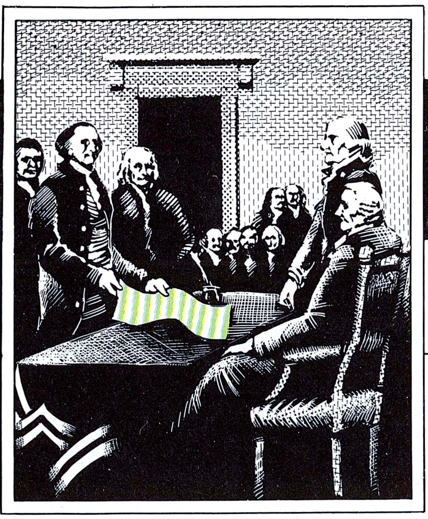

THE RIGHT TO ASSEMBLE

by Ray Duncan

Program Control; The MARK Utility

The tutorial section of this month's column focuses on jumps and branches—the tools allowing us to test data and make our programs do varying things under varying circumstances.

The word *branch* originally implied a conditional jump—one that depended on the outcome of a test. The term came into use because it conveyed the image of a fork in the limb of a tree; that is, it suggested that the computer might "decide" to take one branch of a fork or the other. Over time, the term has taken on a more general meaning, implying either a conditional or unconditional program jump; in most current computer literature, this column included, the words *branch* and *jump* are used fairly interchangeably.

To take a conditional action based on some data test performed at runtime, a program written for the 8088 needs to go through a two-step procedure: First it must perform an operation on the data that will cause one of the CPU's status flags to be set; then it must execute a conditional jump based on that flag.

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There are five status flags affected by all arithmetic/logical instructions: Zero, Sign, Parity, Overflow, and Carry. Some of these are also set according to the results of other instructions, such as shifts, rotates, increments, and decrements.

The Zero flag is set if the value of a result is zero, or if two numbers compared are equal.

The Sign flag is set if the value of a result is negative, or if the destination operand of a compare operation is less than the source operand.

The condition of the Parity flag depends on the number of 1 bits in the lower eight bits of a result; the flag is set if there's an even number of 1 bits and cleared if there is an odd number.

The Overflow flag is set when the result of a signed arithmetic operation is too large or too small for the destination. For example, if a register contains 7FFFH or 32767 (the largest possible signed sixteen-bit integer) and you add 1 to that register, the result will be 8000H or −32768 (the smallest possible signed integer) and the Overflow flag will be set.

It is easiest to think of the Carry flag as an equivalent of Overflow for unsigned operations. For example, if a register contains 0FFFFH (the largest possible unsigned integer) and you add 1 to that register, the result will be 0 and the Carry flag will be set. In subtraction, the Carry flag is inverted and indicates a borrow. There is also an Auxiliary Carry flag that is employed in BCD arithmetic and is not usually useful in ordinary applications; we'll simply ignore it for now.

The designers of the 8088 included a host of conditional jump instructions, which take into account most of the meaningful settings and combinations of the status flags. Unlike many earlier microprocessors, the 8088 provides jumps based on both signed and unsigned comparisons. Some of the jumps have different names to make them easier to think about but are assembled into the same machine code (see table 1). In practice, the jumps contingent on parity, carry, and overflow are infrequently used; you should probably avoid these until you feel at ease with 8088 assembly language.

To get the flags set, we can take several courses. If we're examining a single value to see if it's positive, negative, or zero, we can simply Inclusive OR it with itself. This leaves the value unchanged but sets the Sign, Zero, and Parity status flags. For example, to check whether the value in register AX is zero, we can code:

```
        OR      AX,AX
        JZ      IT_IS_ZERO
        JMP     IT_ISN'T_ZERO
```

To test whether specific bits of a value are set, we can use the TEST instruction, which essentially applies a mask to the value but leaves it unmodified. For example, to test whether bit 0 of the number in register AX is set, we can write:

```
        TEST    AX,1
        JZ      BIT_NOT_SET
        JMP     BIT_SET
```

In its effect on the status flags, TEST AX,1 is exactly the same as AND AX,1, except that TEST leaves the contents of register AX unchanged. It's worth noting here that although one can TEST any general register against a constant value, a TEST of AX has a special machine instruction that is significantly faster.

You can also set the status flags by comparing one value with another. The two data items to be compared can be both in registers, one can be "immediate data," or one value can be in a register and the other in memory. In its effect on the status flags, the comparison behaves as though the source operand were subtracted from the destination operand; but, of course, the two values compared are left unchanged.

For example, to compare the contents of register AX with the value 5, you can code:

```
        CMP     AX,5
        JG      GREATER_THAN_FIVE
        JMP     NOT_GREATER_THAN_
                FIVE
```

Any arithmetic or logical operation using two values causes the destination operand to be replaced with the result and sets the status flags accordingly. For example, the following code adds BX to AX, leaves the result in AX, and branches according to the outcome:

```
        ADD     AX,BX
        JZ      RESULT_IS_ZERO
        JMP     RESULT_ISN'T_ZERO
```

Finally, there are two instructions that allow direct manipulation of the Carry flag: STC (Set Carry) and CLC (Clear Carry). These are often used by subroutines as a convenient way to pass a success or failure code back to the calling routine. An example is provided by PC-DOS itself, which, if it encounters an error during a function call, sets the carry flag before returning control to an application program.

One little hidden "gotcha" to be aware of when you're coding conditional jumps: They assemble only an eight-bit displacement. In

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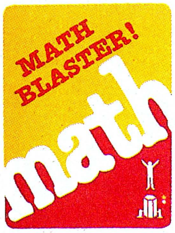

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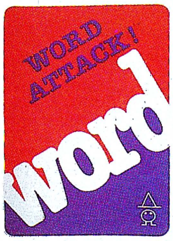

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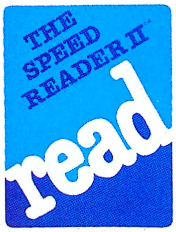

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other words, they can reach only those labels that are within plus 127 or minus 128 bytes of the current program counter location + 2. This limitation sometimes forces you to write a "jump around a jump," which is rather inelegant. For example, the following sequence would be necessary if the label VALUE_IS_ZERO happened to be more than 127 bytes away:

```
        OR   AX,AX
        JNZ  VALUE_NOT_ZERO
        JMP  VALUE_IS_ZERO
VALUE_NOT_ZERO:
```

It is important to notice the distinctions between signed and unsigned jumps. A signed jump acts on the basis of the status flags as though two signed fifteen-bit integers had been compared (each having a value in the range −32768 to 32767). An unsigned jump reacts on the basis of comparing two sixteen-bit positive integers (in other words two values in the range 0 to 65535).

The process of executing a conditional jump does *not* change the contents of the CPU status flags. Their condition remains static until you execute another arithmetic/logical, shift, compare, or test instruction.

Loop Control. It is often necessary to write a program that repeats the same sequence of operations several times; in many cases the number of repetitions needed is not known at assembly time but must be calculated at runtime. In general, you accomplish this by putting the particular sequence of program code inside a construct called a *loop*.

In Basic, loops are provided for explicitly by the *for* and *next* commands. In assembly language programs, loops can be implemented in many ways. Here's one way to fashion a loop:

```
        MOV     register,count
label:  •
        •
        •
        DEC     register
        JNZ     label
```

The code signified by the three dots (ellipses) will be executed *count* times, since the conditional jump will be taken until the register has been decremented to 0. *Count* might be a constant value (that is, determined at assembly or link time) or the contents of a variable (determined at runtime). If the latter is the case, there could be a problem with the code written above: If the beginning count is 0, the loop will be executed 65,536 times! For this loop to be bombproof, it should be written as:

```
        MOV     register,count
        OR      register,register
        JZ      label2
label:  •
        •
        •
        DEC     register
```

```
          JNZ          label
label2:
```

The architects of the 8088 built in two instructions especially designed for the efficient handling of loops. These are JCXZ (jump if register CX is zero) and LOOP (decrement CX register and jump if CX not zero), and they are commonly coded into a loop as follows:

```
          MOV          CX,count
          JCXZ         label2
   label: •
          •
          •
          LOOP         label
label2:
```

Although this code is *almost* equivalent to the previous example, there is at least one important difference. While the *DEC register* instruction sets most of the status flags to reflect the contents of the CX register after the decrement operation, the LOOP instruction does *not* affect the status flags at all.

We are, incidentally, seeing here an example of the much discussed "asymmetry" of the 8088 microprocessor. JCXZ and LOOP carry out their functions assuming that register CX contains the counter; there are no equivalent single instructions to test and branch on the contents of any of the other general registers. This is why the Intel manuals often refer to CX as the "count" register. There are a number of other instructions that also reference CX in a unique way; these include the shift and rotate group and the special string instructions (LODS, STOS, SCAS, CMPS, and MOVS).

Comments on Previous Months' Columns. Steve Harrison of San Diego, California, wrote in about the TALK program (December 1983), asking why we didn't test the status of the COM port to make sure it was ready before outputting a character to it. He wasn't contesting the fact that the program works as advertised; he just wondered why we were taking for granted that the COM port would always be ready to accept data for transmission. A little arithmetic will provide the answer straight-away. Assuming the communications adapter is set for 300 baud, we can expect a maximum data rate of approximately thirty characters per second—or six words per second, as typing teachers are wont to count.

Six words per second is of course the same as 360 words per minute. Since a speed of 60 to 70 words per minute is usually considered to reflect superior typing skill, chances seem minimal that we'll stumble onto a computer operator who might outrun the communications port's ability to cope with the characters as they arrive from the keyboard.

Last month's column, which featured the CLEAN utility, ended with the suggestion that you might, as an exercise, change the PUT_CHAR and GET_CHAR routines to read and write larger records in order to speed up execution of the program. It turns out that if you read and write the files in 1,024-byte blocks, the program will process a file almost exactly ten times as fast as the version printed last month.

Listing 1 contains an excerpt from the enhanced program. In addition to some changes to GET_CHAR and PUT_CHAR, there are four new routines: INIT_BUFFS, READ_BLOCK, WRITE_BLOCK, and FLUSH_BUFFS. A call to INIT_BUFFS must be made after the files are opened but before any other processing is started, and a call to FLUSH_BUFFS must be inserted before the files are closed when processing is completed. *BLKSIZE EQU 1024* must be inserted as an equate at the start of your program, and some changes and additions must be made to the data segment as shown in listing 2.

The MARK Utility

PC-DOS version 1 introduced, and PC-DOS version 2 extended the use of, "attributes" associated with file entries in the disk directory. The attributes are bit flags that specify whether a file is "hidden" or "system" (not to appear on a directory listing), "read-only" (not modifiable or erasable by an application program), or "archived" (backed up since last modified). Attribute flags are also used to identify directory entries that specify volume or subdirectory names.

This month's utility, MARK, demonstrates modification of file attributes and continues our introduction to PC-DOS function calls. This program, requiring DOS 2.0 and written in a form to be assembled and linked into an EXE file, enables you to set a file's status to hidden, read-only, or normal (all special attributes turned off). One obvious use of MARK is to flag all your vital SYS, BAT, COM, and EXE files as read-only, so that you can't trash them by accident with an errant *erase**.*.

How To Use MARK. The command line must contain the name and extension of the desired file, along with a switch that tells the program which action to take. Since you're using DOS 2.0, you can also include a full path specification if you wish. If not supplied in the command line, the path defaults to the current subdirectory, and the disk unit defaults to the current drive.

The MARK utility is invoked in the form:

```
A>MARK filename.ext /x
```

where *x* is a character specifying the desired attribute: H=hidden, N=normal, and R=read-only. To mark the file named XMAS.TXT as read-only, for example, you would enter:

```
A>MARK XMAS.TXT /R
```

If you enter an improper switch or name a nonexistent file, or if you accidentally omit any necessary information, MARK will give you an appropriate error message and provide an example of a proper command line.

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Outline of MARK. The general plan of this utility is as follows:

1. Save on the stack the address for the final return to DOS.
2. Copy the filename passed by DOS from the user's command line into a local buffer and terminate it with a zero byte. If the filename is absent or illegal, print an error message and exit.
3. Locate the switch by scanning for a / character, then pick up the following letter and make sure it is either N, R, or H. If the switch is absent or invalid, print an error message and exit.
4. Modify the file's attribute byte in the disk directory by calling DOS function 43H and passing the address of the filename and the desired characteristics.
5. Print a success message including the name of the file and the action taken; then return control to DOS.

A Closer Look. Like the programs printed in the last several columns, MARK is designed to be assembled into an EXE file. It is divided into a code segment named CSEG that contains all the executable machine code, a data segment named DATA that contains the constants and variables, and a stack segment named STACK that is used as a scratch area by PUSH, POP, CALL and RET instructions.

Within the code segment, there is a main procedure, also named MARK, which contains the primary flow of control for the program; it is delimited by the PROC and ENDP statements and may be found in lines 36 through 87. The logic in this procedure is straightforward and follows the outline given almost exactly.

Following the procedure MARK are several smaller procedures that serve as subroutines for the main-line code. The first of these, PASCIIZ, is found in lines 89 through 110; it simply prints out a filename (in the form of an ASCIIZ string) on the console.

The subroutine INFILE in lines 112 through 148 was lifted directly out of last month's CLEAN utility. It transfers a path and file specification from the command tail buffer, where

Instruction	Flags	Condition
JA	(CF or ZF)=0	Jump if compare above (unsigned)
JAE	CF=0	Jump if compare above or equal (unsigned)
JB	CF=1	Jump if compare below (unsigned)
JBE	(CF or ZF)=1	Jump if compare below or equal (unsigned)
JC	CF=1	Jump if carry flag set
JCXZ	irrelevant	Jump if contents of CX=zero
JE	ZF=1	Jump if compare equal
JG	((SF xor OF) or ZF)=0	Jump if compare greater
JGE	(SF xor OF)=0	Jump if compare greater or equal
JL	(SF xor OF)=1	Jump if compare less than
JLE	((SF xor OF) or ZF)=1	Jump if compare less than or equal
JNA	(CF or ZF)=1	Jump if compare not above (unsigned)
JNAE	CF=1	Jump if compare not above or equal (unsigned)
JNB	CF=0	Jump if not below (unsigned)
JNBE	(CF or ZF)=0	Jump if compare not below or equal (unsigned)
JNC	CF=0	Jump if carry flag not set
JNE	ZF=0	Jump if compare not equal
JNG	((SF xor OF) or ZF)=1	Jump if compare not greater
JNGE	(SF xor OF)=1	Jump if compare not greater or equal
JNL	(SF xor OF)=0	Jump if compare not less
JNLE	((SF xor OF) or ZF)=0	Jump if compare not less or equal
JNO	OF=0	Jump if overflow flag not set
JNP	PF=0	Jump if parity flag not set
JNS	SF=0	Jump if value not negative
JNZ	ZF=0	Jump if value not zero
JO	OF=1	Jump if overflow flag set
JP	PF=1	Jump if parity flag set
JPE	PF=1	Jump if parity even
JPO	PF=0	Jump if parity odd
JS	SF=1	Jump if value negative
JZ	ZF=1	Jump if value zero

Table 1. The conditional jump instructions of the 8088 microprocessor. Information adapted from the Intel literature and the IBM *Technical Reference* manual. Jumps described in terms of greater or less are used with signed comparisons; those described as above or below are used with unsigned comparisons. ZF=Zero Flag, SF=Sign Flag, OF=Overflow Flag, PF=Parity Flag, and CF=Carry Flag.

```
get_char    proc    near                    ;get one character from input buffer
            mov     bx,input_ptr
            cmp     bx,blksize
            jne     get_char1
            call    read_block
            mov     bx,0
get_char1:
            mov     al,[input_buffer+bx]
            inc     bx
            mov     input_ptr,bx
            ret
get_char    endp

put_char    proc    near                    ;put one character into output buffer
            mov     bx,output_ptr
            mov     [output_buffer+bx],al
            inc     bx
            mov     output_ptr,bx
            cmp     bx,blksize              ;buffer full yet?
            jne     put_char1               ;no,jump
            call    write_block             ;yes,write the block
            ret                             ;return CY as status code
put_char1:
            clc                             ;return CY clear for OK status
            ret
put_char    endp

read_block  proc    near
            mov     bx,input_handle         ;read first block of input
            mov     cx,blksize
            mov     dx,offset input_buffer
            mov     ah,3fh
            int     21h
            jnc     read_block1             ;jump if no error status
            mov     ax,0                    ;simulate a zero length read if error
read_block1:
            cmp     ax,blksize              ;was full buffer read in?
            je      read_block2             ;yes,jump
            mov     bx,ax                   ;no, store End-of-File mark
            mov     byte ptr [input_buffer+bx],eof
read_block2:
            xor     ax,ax                   ;initialize input buffer pointer
            mov     input_ptr,ax
            ret
read_block  endp

write_block proc    near                    ;write blocked output (blksize bytes)
            mov     dx,offset output_buffer
            mov     cx,blksize
            mov     bx,output_handle
            mov     ah,40h
            int     21h
            xor     bx,bx                   ;initialize pointer to blocking buffer
            mov     output_ptr,bx
            cmp     ax,blksize              ;was correct length written?
            jne     write_block1            ;no,disk must be full
            clc                             ;yes,return CY=0 indicating all OK
            ret
write_block1:                               ;disk is full, return CY=1
            stc                             ;as error code
            ret
write_block endp
```

it was left by DOS, into a local buffer in MARK's data segment, terminating the string with a zero byte so that it's acceptable to the DOS 2.0 file functions.

The procedure GET_SWITCH in lines 151 through 186 scans the command line tail for the / character, then picks up the next letter and makes sure it is N, H, or R. If the procedure locates a legal switch, it returns the appropriate attribute bits and the address of a corresponding message to the main routine. If the switch is missing or incorrect, an error status is returned via the Carry flag.

The subroutine ERROR is passed the address of an appropriately descriptive message, which it displays on the screen along with some help information.

Following these auxiliary procedures, we find the DATA segment in lines 207 through 278 and the STACK segment in lines 283 through 288. These don't contain anything unconventional this month. Finally, the whole program is terminated with an END command in line 289, which also designates the label MARK as the entry point from DOS.

An interesting and subtle point in the coding of this program is that at the original entry from DOS, the DS and ES registers are set to the segment of the Program Segment Prefix, which includes the command tail. MARK preserves the original contents of DS long enough to acquire the filename and switch from the command tail, while it uses the ES register to address its own data segment. Eventually, it also sets DS to the segment of its own data area, a necessity before it can ask DOS to change the file attribute or print any messages.

Further reading that you will find helpful: the description of file attributes on page C-4 of the DOS 2.0 manual and the detailed specification for function call 43H, located on D-39 of the same tome.

The MARK utility provides a substrate that you can easily extend with many more useful features. Two obvious extensions are the ability to accept wildcard file specifications and the ability to add or change volume labels after a disk is formatted. Good luck! ▲

```
init_buffs   proc      near
             call      read_block          ;read 1st block of input
             xor       ax,ax               ;initialize pointer to output
             mov       output_ptr,ax       ;output blocking buffer
             ret
init_buffs   endp

flush_buffs  proc      near                ;write any data in output buffer to disk
             mov       cx,output_ptr
             or        cx,cx
             jz        flush_buffs1        ;jump,buffer is empty
             mov       bx,output_handle
             mov       dx,offset output_buffer
             mov       ah,40h
             int       21h
             cmp       ax,output_ptr       ;was write successful?
             jnz       flush_buffs2        ;no,jump
flush_buffs1:
             clc                           ;yes,return CY=0 for
             ret                           ;success flag
flush_buffs2:                              ;disk was full so write failed,
             stc                           ;return CY=1 as error flag
             ret
flush_buffs  endp
```

Listing 1.

```
input_ptr        dw      0                  ;pointer to input blocking buffer
output_ptr       dw      0                  ;pointer to output blocking buffer

input_buffer     db      blksize dup (?)    ;buffer for deblocking of data
                                            ;from input file

output_buffer    db      blksize dup (?)    ;buffer for blocking of data
                                            ;sent to output file
```

Listing 2.

```
1                                   name      mark
2                                   page      55,132
3                                   title     'MARK—set attribute of file'
4                         ;
5                         ; MARK—Utility to set attribute of file.
6                         ; Version 1.0  20 December 1983
7                         ; Requires PC-DOS 2.0 for execution.
8                         ;
9                         ; Program is called by command of the form:
10                        ;       A>MARK path\file.ext /x
11                        ; where x=R for read-only, H for hidden,
12                        ; or N for normal (all attrib bits off).
13                        ;
14                        ; Copyright (c) 1983 Ray Duncan
15                        ; May be freely modified and reproduced
16                        ; for noncommercial use.
17
18   = 000D               cr          equ       0dh          ;ASCII carriage return
19   = 000A               lf          equ       0ah          ;ASCII line feed
20   = 0024               eom         equ       'S'          ;end of message flag
21
22   = 0080               command     equ       80h          ;Command line buffer
23
24   = 0001               rd_only     equ       01h          ;file attributes
25   = 0002               hidden      equ       02h
26   = 0004               system      equ       04h
27   = 0008               volume      equ       08h
28   = 0010                           subdir      equ       10h
29   = 0020                           archive     equ       20h
30
31
32   0000                             cseg        segment   para public 'CODE'
33
34                                                assume    cs:cseg,ds:data,es:data,ss:stack
35
36   0000                             mark        proc      far              ;entry point from PC-DOS
37
38   0000    1E                                   push      ds               ;save DS:0000 for final
39   0001    33 C0                                xor       ax,ax            ;return to PC-DOS
40   0003    50                                   push      ax
41   0004    B8 —R                                mov       ax,data          ;make our data segment addressable
42   0007    8E C0                                mov       es,ax            ;via the ES register
43   0009    E8 0069 R                            call      infile           ;get path and name for
44                                                                           ;file to be modified.
45   000C    73 07                                jnc       mark1            ;jump if filename was ok
46   000E    BA 0040 R                            mov       dx,offset msg1   ;filename absent or illegal,
47   0011    E8 00C1 R                            call      error            ;print error message and exit
48   0014    CB                                   ret
49
50   0015                             mark1:                                 ;filename was ok, now try
51   0015    E8 008F R                            call      get_switch       ;and find the switch
52   0018    73 07                                jnc       mark2            ;jump if switch was ok
53   001A    BA 00D0 R                            mov       dx,offset msg7   ;missing switch, print error
54   001D    E8 00C1 R                            call      error            ;message and exit
55   0020    CB                                   ret
56
57   0021                             mark2:                                 ;found legal switch, now
58   0021    52                                   push      dx               ;save addr of success message
59   0022    8C C0                                mov       ax,es            ;make our data segment addressable
60   0024    8E D8                                mov       ds,ax            ;via the DS register
61                                                                           ;CX=attrib bits,
62                                                                           ; already set by "get_switch"
63                                                                           ;DS:DX=addr of filename
64   0026    BA 0000 R                            mov       dx,offset input_name
65   0029    B4 43                                mov       ah,43h           ;function 43h=CHMOD
66   002B    B0 01                                mov       al,01            ;AL=01 for set attrib
67   002D    CD 21                                int       21h              ;make request to PC-DOS
68   002F    73 08                                jnc       mark3            ;if CY=0 jump, successful call
69                                                                           ;if CY=1 call failed,
70   0031    5A                                   pop       dx               ;clean up stack, and
71   0032    BA 0055 R                            mov       dx,offset msg2   ;print error message
72   0035    E8 00C1 R                            call      error
73   0038    CB                                   ret
74
75   0039                             mark3:                                 ;attribute was modified,
76   0039    BA 0067 R                            mov       dx,offset msg3   ;print 1st part of success message
77   003C    B4 09                                mov       ah,9
78   003E    CD 21                                int       21h
79                                                                           ;print filename
80   0040    BA 0000 R                            mov       dx,offset input_name
81   0043    E8 004C R                            call      pasciiz
82   0046    5A                                   pop       dx               ;print last part of success msg.
83   0047    B4 09                                mov       ah,9
84   0049    CD 21                                int       21h
85
86   004B    CB                                   ret                        ;final exit to PC-DOS
87   004C                                         mark      endp
88
89   004C                             pasciiz     proc      near             ;print the ASCIIZ string
90                                                                           ;whose offset is in DX on
91                                                                           ; the standard output device.
92                                                                           ;Regs AX, BX also destroyed.
93   004C    8B DA                                mov       bx,dx            ;let BX=offset of string
94   004E                             pasciiz1:
95   004E    8A 17                                mov       dl,[bx]          ;get next char from string
96   0050    0A D2                                or        dl,dl            ;if char.=zero, end of string
97   0052    74 14                                jz        pasciiz9         ;jump if end
98   0054    80 FA 41                             cmp       dl,'A'           ;if it is an uppercase alpha
99   0057    72 08                                jb        pasciiz2         ;character, fold to lowercase
100  0059    80 FA 5A                             cmp       dl,'Z'           ;Note: Inclusive Or of an alpha
101  005C    77 03                                ja        pasciiz2         ;ASCII character with 20h has the
102  005E    80 CA 20                             or        dl,20h           ;effect of folding to lowercase.
103  0061                             pasciiz2:
104  0061    B4 02                                mov       ah,2             ;function 2=output char.
105  0063    CD 21                                int       21h              ;request output by PC-DOS
106  0065    43                                   inc       bx               ;advance to next string position
107  0066    EB E6                                jmp       short pasciiz1
108  0068                             pasciiz9:                              ;done with string output,
109  0068    C3                                             ret              ;return to caller
110  0069                             pasciiz     endp
111
```

```
0069                   infile       proc       near            ;Capture the name of a file
                                                               ;from the command tail buffer
                                                               ;where it was left by PC-DOS,
                                                               ;transferring it into a local
                                                               ;buffer in the form of an
                                                               ;ASCIIZ string.

                                                               ;DS:SI <-  addr of command tail
0069    BE 0080                     mov        si,offset command
                                                               ;ES:DI <-  addr of local buffer
006C    BF 0000 R                   mov        di,offset input_name
006F    FC                          cld                        ;make sure direction flag cleared
0070    AC                          lodsb                      ;first check count byte to make
0071    0A C0                       or         al,al           ;sure command tail is present
0073    74 18                       jz         infile4         ;return error status if not.
0075                   infile1:                                ;scan over leading blanks to
0075    AC                          lodsb                      ;find the path and filename
0076    3C 0D                       cmp        al,cr           ;if we run into carriage return,
0078    74 13                       jz         infile4         ;filename is missing, so exit.
007A    3C 20                       cmp        al,20h          ;if this char is a blank,
007C    74 F7                       jz         infile1         ;keep scanning.
007E                   infile2:                                ;found 1st char of name,
007E    AA                          stosb                      ;transfer the name to local buffer.
007F    AC                          lodsb                      ;check next character, found
0080    3C 0D                       cmp        al,cr           ;end of string yet?
0082    74 04                       je         infile3         ;yes if either carriage return
0084    3C 20                       cmp        al,20h
0086    75 F6                       jne        infile2
0088                   infile3:                                ;path and filename successfully
0088    32 C0                       xor        al,al           ;transferred to local buffer,
008A    AA                          stosb                      ;store 0 byte at end of string
008B    F8                          clc                        ;and exit with Carry flag =0
008C    C3                          ret
008D                   infile4:                                ;some type of error was detected
008D    F9                          stc                        ;so exit with Carry flag =1
008E    C3                          ret
008F                   infile       endp


008F                   get_switch proc         near            ;Scan the input line for a " "
                                                               ;delimiting a switch, then make
                                                               ;sure it is legal.
                                                               ;Return CY=0 if legal switch, and
                                                               ;CX=attrib byte, DX=msg addr
                                                               ;Return CY=1 if switch no good
008F    BE 0081                     mov        si,offset command+1  ; DS:SI = addr of command line
0092                   get_switch1:                            ;look for "/" character
0092    AC                          lodsb
0093    3C 0D                       cmp        al,cr           ;if we run into a carriage return,
0095    74 28                       jz         get_switch9     ;switch missing so take error exit.
0097    3C 2F                       cmp        al,'/'
0099    75 F7                       jne        get_switch1     ;not '/' yet, keep looking.
009B    AC                          lodsb                      ;found '/', pick up next char.
009C    0C 20                       or         al,20h          ;and fold to lowercase.
009E    3C 72                       cmp        al,'r'          ;R = read only
00A0    75 07                       jne        get_switch2     ;not R, jump
00A2    B9 0001                     mov        cx,rd_only      ;R so set read only attrib bit
00A5    BA 0097 R                   mov        dx,offset msg5
00A8    C3                          ret                        ;return CY=0 for success
00A9                   get_switch2:                            ;check for H=hidden
00A9    3C 68                       cmp        al,'h'
00AB    75 07                       jne        get_switch3     ;not H, jump
00AD    B9 0002                     mov        cx,hidden       ;H so set hidden attrib bit
00B0    BA 007C R                   mov        dx,offset msg4
00B3    C3                          ret                        ;return CY=0 for success
00B4                   get_switch3:                            ;check for N=normal
00B4    3C 6E                       cmp        al,'n'
00B6    75 07                       jne        get_switch9     ;not N,jump to error exit
00B8    B9 0000                     mov        cx,0            ;clear all attrib bits
00BB    BA 00B5 R                   mov        dx,offset msg6
00BE    C3                          ret                        ;return CY=0 for success
00BF                   get_switch9:                            ;missing or illegal switch,
00BF    F9                          stc                        ;return CY flag=1 as alarm
00C0    C3                          ret
00C1                   get_switch endp


00C1                   error        proc       near            ;print error message
00C1    B8 —R          mov          ax,data                    ;make sure data area addressable
00C4    8E D8                       mov        ds,ax
00C6    B4 09                       mov        ah,9            ;print error type
00C8    CD 21                       int        21h
00CA    BA 00ED R                   mov        dx,offset helpmsg
00CD    B4 09                       mov        ah,9            ;also print HELP information
00CF    CD 21                       int        21h
00D1    C3                          ret                        ;back to caller
00D2                   error        endp


00D2                   cseg         ends



                                                               ;declare a data segment for
                                                               ;storage of miscellaneous
                                                               ;constants and variables
0000                   data         segment    para public 'DATA'

0000        40 [       input_name   db         64 dup (0)      ;buffer for path and filename
              00
                 ]


0040    0D 0A          msg1         db         cr,lf
0042    4D 69 73 73 69 6E           db         'Missing filename.',eom
        67 20 66 69 6C 65
        20 6E 61 6D 65 2E
        24

0055    0D 0A          msg2         db         cr,lf
0057    46 69 6C 65 20 6E           db         'File not found.',eom
        6F 74 20 66 6F 75
        6E 64 2E 24

0067    0D 0A          msg3         db         cr,lf
0069    41 74 74 72 69 62           db         'Attribute of file ',eom
        75 74 65 20 6F 66
        20 66 69 6C 65 20
        24

007C    20 68 61 73 20 62  msg4          db        ' has been set to Hidden.'
        65 65 6E 20 73 65
        74 20 74 6F 20 48
        69 64 64 65 6E 2E
0094    0D 0A 24                         db        cr,lf,eom

0097    20 68 61 73 20 62  msg5          db        ' has been set to Read-Only.'
        65 65 6E 20 73 65
        74 20 74 6F 20 52
        65 61 64 2D 4F 6E
        6C 79 2E
00B2    0D 0A 24                         db        cr,lf,eom

00B5    20 68 61 73 20 62  msg6          db        ' has been set to Normal.'
        65 65 6E 20 73 65
        74 20 74 6F 20 4E
        6F 72 6D 61 6C 2E
00CD    0D 0A 24                         db        cr,lf,eom

00D0    0D 0A              msg7          db        cr,lf
00D2    4D 69 73 73 69 6E                db        'Missing or illegal switch.',eom
        67 20 6F 72 20 69
        6C 6C 65 67 61 6C
        20 73 77 69 74 63
        68 2E 24

00ED    20 20 43 6F 6D 6D helpmsg        db        '  Command should be in the form: '
        61 6E 64 20 73 68
        6F 75 6C 64 20 62
        65 20 69 6E 20 74
        68 65 20 66 6F 72
        6D 3A 20
010E    0D 0A 0A                         db        cr,lf,lf
0111    20 20 4D 41 52 4B                db        '  MARK filename /x'
        20 66 69 6C 65 6E
        61 6D 65 20 2F 78
0123    0D 0A 0A                         db        cr,lf,lf
0126    78 3D 4E 20 66 6F                db        'x=N for normal, R for read-only, H for hidden.'
        72 20 6E 6F 72 6D
        61 6C 2C 20 52 20
        66 6F 72 20 72 65
        61 64 2D 6F 6E 6C
        79 2C 20 48 20 66
        6F 72 20 68 69 64
        64 65 6E 2E
0154    0D 0A 24                         db        cr,lf,eom

0157                      data           ends

                                                             ;declare a stack segment of 64 bytes
                                                             ;for use as scratch area by such
                                                             ;instructions as PUSH, POP, CALL, RET
0000                      stack          segment   para stack 'STACK'
0000    40 [                             db        64 dup (?)
           ??
              ]

0040                      stack          ends

                          end            mark
```

Listing 3

```
Segments and groups:
            Name               Size     align    combine  class
CSEG  . . . . . . . . . . . .  00D2     PARA     PUBLIC   'CODE'
DATA  . . . . . . . . . . . .  0157     PARA     PUBLIC   'DATA'
STACK . . . . . . . . . . . .  0040     PARA     STACK    'STACK'

Symbols:
            Name               Type     Value    Attr
ARCHIVE . . . . . . . . . . .  Number   0020
COMMAND . . . . . . . . . . .  Number   0080
CR  . . . . . . . . . . . . .  Number   000D
EOM . . . . . . . . . . . . .  Number   0024
ERROR . . . . . . . . . . . .  N PROC   00C1     CSEG     Length =0011
GET_SWITCH  . . . . . . . . .  N PROC   008F     CSEG     Length =0032
GET_SWITCH1 . . . . . . . . .  L NEAR   0092     CSEG
GET_SWITCH2 . . . . . . . . .  L NEAR   00A9     CSEG
GET_SWITCH3 . . . . . . . . .  L NEAR   00B4     CSEG
GET_SWITCH9 . . . . . . . . .  L NEAR   00BF     CSEG
HELPMSG . . . . . . . . . . .  L BYTE   00ED     DATA
HIDDEN  . . . . . . . . . . .  Number   0002
INFILE  . . . . . . . . . . .  N PROC   0069     CSEG     Length =0026
INFILE1 . . . . . . . . . . .  L NEAR   0075     CSEG
INFILE2 . . . . . . . . . . .  L NEAR   007E     CSEG
INFILE3 . . . . . . . . . . .  L NEAR   0088     CSEG
INFILE4 . . . . . . . . . . .  L NEAR   008D     CSEG
INPUT_NAME  . . . . . . . . .  L BYTE   0000     DATA     Length =0040
LF  . . . . . . . . . . . . .  Number   000A
MARK  . . . . . . . . . . . .  F PROC   0000     CSEG     Length =004C
MARK1 . . . . . . . . . . . .  L NEAR   0015     CSEG
MARK2 . . . . . . . . . . . .  L NEAR   0021     CSEG
MARK3 . . . . . . . . . . . .  L NEAR   0039     CSEG
MSG1  . . . . . . . . . . . .  L BYTE   0040     DATA
MSG2  . . . . . . . . . . . .  L BYTE   0055     DATA
MSG3  . . . . . . . . . . . .  L BYTE   0067     DATA
MSG4  . . . . . . . . . . . .  L BYTE   007C     DATA
MSG5  . . . . . . . . . . . .  L BYTE   0097     DATA
MSG6  . . . . . . . . . . . .  L BYTE   00B5     DATA
MSG7  . . . . . . . . . . . .  L BYTE   00D0     DATA
PASCIIZ . . . . . . . . . . .  N PROC   004C     CSEG     Length =001D
PASCIIZ1  . . . . . . . . . .  L NEAR   004E     CSEG
PASCIIZ2  . . . . . . . . . .  L NEAR   0061     CSEG
PASCIIZ9  . . . . . . . . . .  L NEAR   0068     CSEG
RD_ONLY . . . . . . . . . . .  Number   0001
SUBDIR  . . . . . . . . . . .  Number   0010
SYSTEM  . . . . . . . . . . .  Number   0004
VOLUME  . . . . . . . . . . .  Number   0008
Warning    Severe
Errors     Errors
0          0
```

softalk presents the bestsellers

This is the month in which we report Christmas sales. Sales of most packages were up, fueled by the holiday euphoria and the expansion of business budgets before the end of the fiscal year. As you might expect, December was a case of the rich getting richer.

Even astute observers could miss the minute change in the composition of the Top Thirty. Only one program, *General Ledger* from BPI, was new to the list. The dropout was *Volkswriter.* That was not a big falling off; *Volkswriter* actually sold better in December than in November, but it ended up thirty-first.

The static nature of the Top Thirty emphasizes the enigma that is the IBM Personal Computer software market. The advent of the PC brought forth the greatest outpouring of new software in a short time span of any personal computer. Many have called, but very few have been chosen.

The lack of success experienced by many software publishers certainly hasn't been because of shortcomings in their product lines. For the most part, software conceived for the PC is more ambitious and better executed than its counterparts on other microcomputers. If that implies, as it does, a plethora of good software for the PC, then why do a relative handful of programs dominate sales?

One obvious possibility is that there are distinct and recognizable added features in the leaders that are missing in the other packages. That assumption would be challenged by every one of the second-tier companies. SPI and Ovation won't grant *1-2-3* a millimeter of advantage. Symmetric Software, Marc Software, and Ann Arbor Software won't yield an inch to *WordStar, MultiMate,* or *PFS:Write*. Decision Support Systems won't give a thing to *Home Accountant*.

Even granting that different software packages have different features, which implies different levels of acceptability, the apparent homogeneity of the IBM market is difficult to accept. Quality of product and intelligent marketing go a long way toward putting distance between competing packages, but it's not clear that the presence of those elements in the leading packages provides complete answers.

One of the anomalies of the PC aftermarket is that most retail outlets carry so few titles. That's a trend not seen in the markets of other microcomputers. And it raises the chicken-and-egg question. Which comes first, retail demand or quality distribution?

Concurrent with the first wave of quality PC software was the retrenchment of the major distributors. Chief among the changes that occurred was that Softsel, the giant in software distribution, put the brakes on its aggressive acquisition of new titles and new publishers.

Softsel had been the driver in the Apple and Atari software markets, actively seeking out quality new product and bringing it to the attention of their retail clients. As their traditional markets softened, Softsel moved to a more conservative approach. Fewer products were added to the catalog, and most that were added had to have proved their attractiveness to the market before Softsel bought in.

The catch, of course, was for a new software publisher to establish a track record for a new product without the aid of the established channels. Recently, only Softword Systems, with *MultiMate*, has been able to find a way around that conundrum. Other new programs that have scored in the PC market have been the product of established publishers with distribution channels already in place.

That's a discouraging aspect of the market for PC owners and new publishers alike. If only the entrenched publishers can get product moved, the market will receive only software very much like the product it already has. Success breeds its own reinforcement. Innovation and applications breakthroughs will be discouraged as needless risks.

If you wait until April 15th to buy your tax software, the name of the program you get is Pay & Pay & Pay & . . .

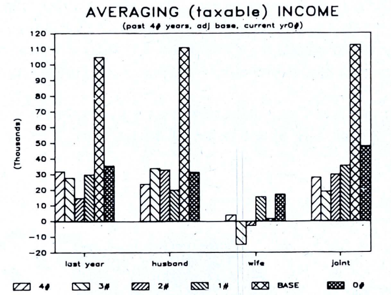
Buy 1040Plan™
early and save!

A Tax Software Template for 1-2-3™

1040Plan is so powerful that it can only be run on Lotus 1-2-3 with 256K RAM. VisiCalc™, Multiplan™, and other calc spreadsheets are either too slow or too small to handle a professional template like **1040Plan.** The template runs on any computer that runs Lotus's 1-2-3.

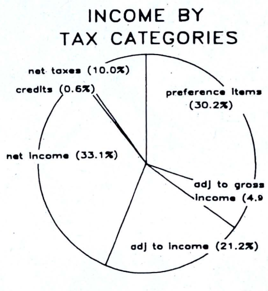
1040Plan does limitations tests and is interactive. Data is transferred between forms automatically, such as earned income and tax preference items. **1040Plan** will compute and print comparisons of married couples filing separate returns (any status) with a combined joint return using the regular tax table or income averaging. *Macro commands ease data entry, report generating, and graphing.*

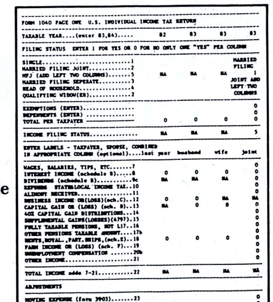
1040Plan was designed and written by William A. Permar, CPA, who has twelve years experience in tax planning for individuals and closely held businesses.



TAX FORMS COMPUTED:

1040
Page 1 and 2
Schedule A
Itemized Deductions
Schedule B
Interest & Dividends
Schedule C
Profit (Loss) Business
Schedule D
Capital Gains (Loss)
Schedule E
Supplemental Income
Schedule G
Income Averaging
Schedule SE
Self Employment Tax
Schedule W
Deduction for Married Couple
Form 2119
Sale of Residence
Form 2441
Credit for Child Care
Form 3468
Investment Credit
Form 6251
Alternative Minimum Tax





```
----------------------------------------------------------------------
FORM 1040 PAGE ONE  U.S. INDIVIDUAL INCOME TAX RETURN
----------------------------------------------------------------------
TAXABLE YEAR....(enter 83,84).....      82       83       83       83
----------------------------------------------------------------------
FILING STATUS  ENTER 1 FOR YES OR 0 FOR NO ONLY ONE "YES" PER COLUMN
----------------------------------------------------------------------
SINGLE...............................1                        MARRIED
MARRIED FILING JOINT.................2                         FILING
MFJ (ADD LEFT TWO COLUMNS)...........5  NA       NA       NA        1
MARRIED FILING SEPERATE..............3                       JOINT AND
HEAD OF HOUSEHOLD....................4                        LEFT TWO
QUALIFYING WIDOW(ER).................2                         COLUMNS
----------------------------------------------------------------------
EXEMPTIONS (ENTER)...................                               0
DEPENDENTS (ENTER) ..................                               0
TOTAL PER TAXPAYER ------------------    0        0        0        0
----------------------------------------------------------------------
INCOME FILING STATUS.................   NA       NA       NA        5
----------------------------------------------------------------------
ENTER LABELS - TAXPAYER, SPOUSE, COMBINED
IN APPROPRIATE COLUMN (optional)....last year husband    wife   joint
----------------------------------------------------------------------
WAGES, SALARIES, TIPS, ETC.......7                                  0
INTEREST INCOME (schedule B).....8       0        0        0        0
DIVIDENDS (schedule B)...........9c     NA       NA       NA        0
REFUNDS  STATE&LOCAL INCOME TAX..10                                 0
ALIMONY RECEIVED.................11                                 0
BUSINESS INCOME OR(LOSS)(sch.C)..12      0        0       NA       NA
CAPITAL GAIN OR (LOSS) (sch. D)..13     NA        0        0        0
40% CAPITAL GAIN DISTRIBUTIONS...14                                 0
SUPPLEMENTAL GAINS(LOSSES)(4797).15                                 0
FULLY TAXABLE PENSIONS, NOT L17..16                                 0
OTHER PENSIONS TAXABLE AMOUNT....17b                                0
RENTS,ROYAL.,PART.SHIPS,(sch.E)..18      0        0        0        0
FARM INCOME OR (LOSS) (sch. F)...19                                 0
UNEMPLOYMENT COMPENSATION .......20b                                0
OTHER INCOME.....................21                                 0
----------------------------------------------------------------------
TOTAL INCOME adds 7-21...........22     NA       NA       NA       NA
----------------------------------------------------------------------
ADJUSTMENTS
----------------------------------------------------------------------
MOVING EXPENSE (form 3903).......23                                 0
EMPLOYEE BUSINESS EXP(form 2106).24                                 0
PAYMENTS TO AN IRA...............25                                 0
PAYMENTS TO A KEOGH(H.R.10)PLAN..26                                 0
PENALTY ON EARLY WITHDRAWAL......27                                 0
ALIMONY PAID.....................28                                 0
DEDUCTION MARRIED COUPLE (sch.W).29     NA       NA       NA       NA
DISABILITY INCOME EXC(form 2440).30                                 0
----------------------------------------------------------------------
TOTAL ADJUSTMENTS adds 23-30.....31     $0       $0       $0       NA
----------------------------------------------------------------------
ADJUSTED GROSS INCOME 22 less 31.32     NA       NA       NA       NA
----------------------------------------------------------------------
```

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What's required is a rethinking by retailers and distributors of their role in the sales chain. Their best interests are not served by limiting access to only a few large and successful publishers. If that trend continues, soon the software publishers will be dictating terms. That's as unhealthy as if the distribution chain dictated the terms.

The best possible alternative is a marketplace where publishers and distributors conduct arm's-length transactions that foster competition while rewarding the best product. When the process approximates that goal, there will be free entrance to new competitors with sound software. That's when the PC owner will benefit the most.

In the meantime, a few publishers will continue to dominate the bestseller lists. Lotus, Microsoft, Software Publishing Corporation, Infocom, Ashton-Tate, and a handful of others will take the lion's share without the pressures of a highly competitive environment.

It's true that there are competitive pressures in other markets that these publishers sell into, and those pressures keep the companies working on better product. But the IBM market is the big one. Competitive pressure there would be the goad that would spur each of these companies to achieve their highest levels of excellence.

IBM Personal Computer owners can only hope that such a time is not far off. ▲

the top thirty

IBM-franchised retail stores representing approximately 4.79 percent of all sales of IBM and IBM-related products volunteered to participate in the poll.

Respondents were contacted early in January to ascertain their sales for the month of December.

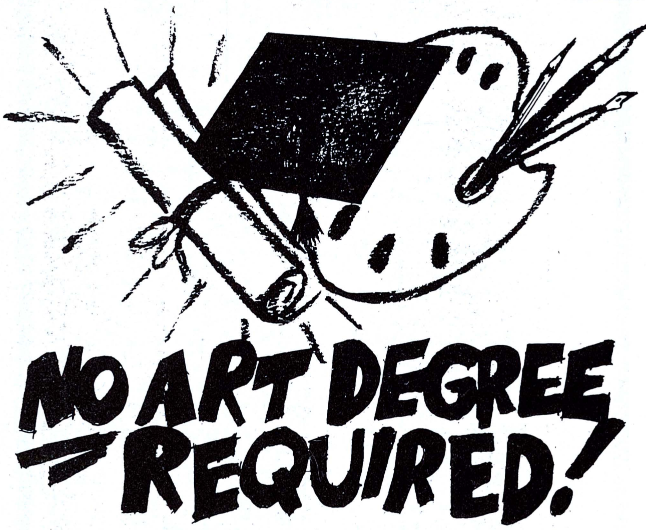
The only criterion for inclusion on the list was the number of units sold; such other criteria as quality of product, profitability to the computer store, and personal preference of the individual respondents were not considered.

Respondents in January represented every geographical area of the continental United States.

Results of the responses were tabulated using a formula that resulted in the index number to the left of the program name in the Top Thirty listing. The index number is an arbitrary measure of relative strength of the programs listed. Index numbers are correlative only to the month in which they are printed; readers cannot assume that an index rating of 50 in one month represents equivalent sales to an index number of 50 in another month.

Probability of statistical error is plus or minus 3.83 percent, which translates roughly into the theoretical possibility of a change of 4.01 points, plus or minus, in any index number.

This Month	Last Month	Index	
1	1	189.62	**1-2-3**, Mitch Kapor and Jonathan Sachs; Lotus Development
2	4	96.77	**Microsoft Flight Simulator**, Bruce Artwick; Microsoft
3	7	74.67	**MasterType**, Lightning Software/Bruce Zweig; Scarborough Systems
4	2	72.70	**WordStar**; MicroPro
5	6	70.74	**PFS:File**, John Page and D.D. Roberts; Software Publishing Corporation
6	5	57.96	**dBase II**, Wayne Ratliff; Ashton-Tate
7	17	56.98	**Zork I**; Infocom
8	19	52.56	**Zork III**; Infocom
9	24	52.07	**Zork II**; Infocom
10	15	50.60	**PFS:Write**, Sam Edwards, Brad Crain, and Ed Mitchell; Software Publishing Corporation
11	3	48.14	**MultiMate**; SoftWord Systems
12	10	47.65	**Home Accountant Plus**, Mike Farmer, Bob Schoenburg, Larry Grodin, and Steve Pollack; Continental Software
13	13	44.21	**Multiplan**; Microsoft
14	21	41.75	**WordPerfect**, Alan Ashton and Bruce Bastian; Satellite Software International
15	23	37.82	**Cdex Training for the IBM PC**, Rohit Patel; Cdex Corporation
16	21	36.35	**PFS:Report**, John Page; Software Publishing Corporation
17	18	35.86	**VisiCalc**, Software Arts/Dan Bricklin and Robert Frankston; VisiCorp, IBM
18	14	33.89	**Typing Tutor**, Michael Sierchio (Dick Ainsworth and Al Baker); IBM (Microsoft)
19	11	32.91	**Basic Compiler**, Microsoft; IBM
20	8	28.98	**Macro Assembler**, Microsoft; IBM
21	12	27.01	**Norton Utilities**, Peter Norton; Peter Norton Inc.
22	28	24.56	**PFS:Graph**, Bessie Chin and Stephen Hill; Software Publishing Corporation
23	16	24.07	**The Instructor**, Jo-L Hendrickson; Individual Software
	24	24.07	**EasyWriter II**, Basic Software Group; Information Unlimited Software
25	9	23.08	**Crosstalk**, Microstuf
26	19	21.61	**PC Tutor**, Lora Meise and Rick Lane; Comprehensive Software Support
27	24	17.19	**SuperCalc2**; Sorcim
28	30	13.26	**ProKey**, David Rose; RoseSoft
	—	13.26	**General Ledger**, John Moss and Ken Debower; IBM (BPI)
30	28	12.77	**Word**; Microsoft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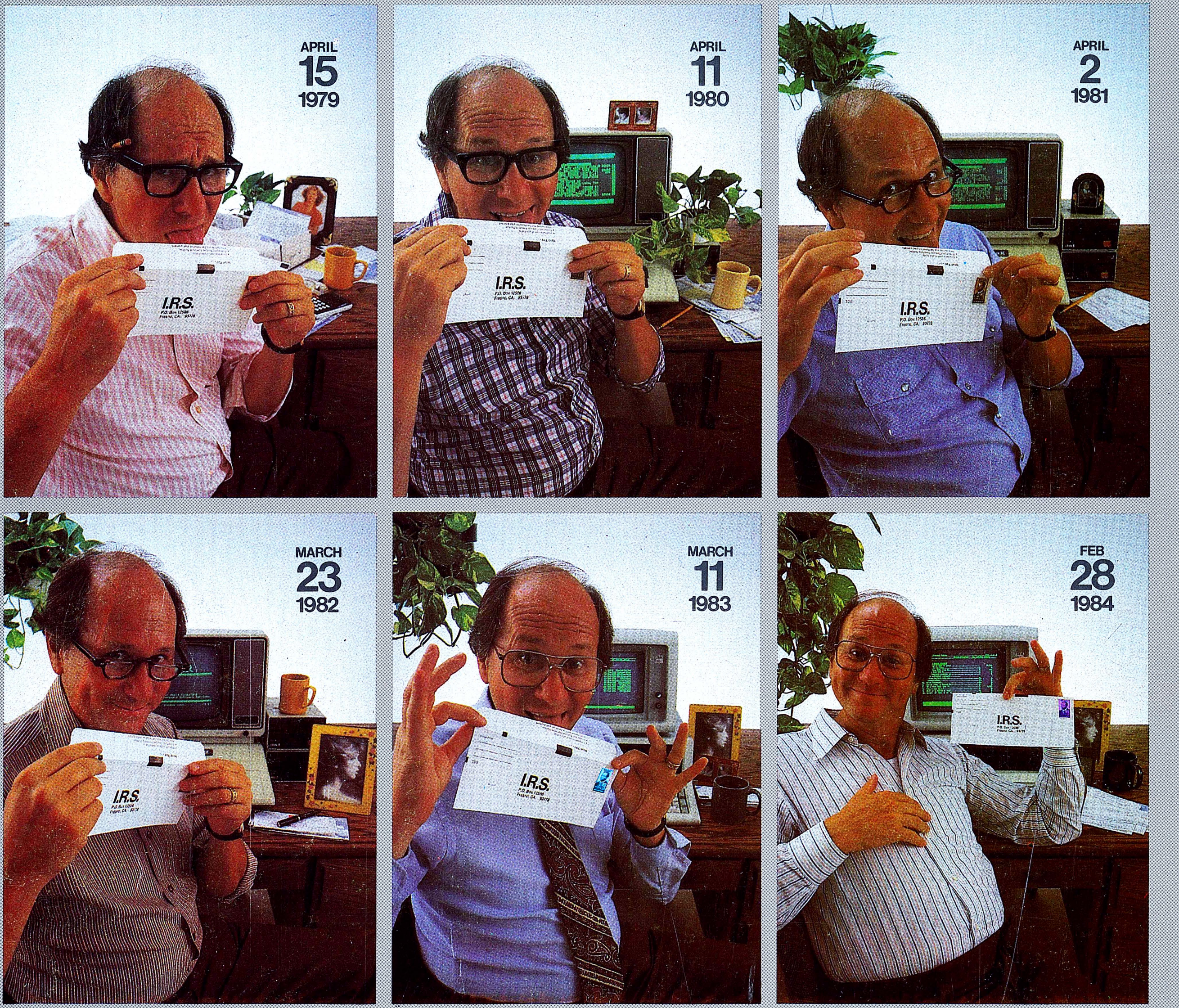
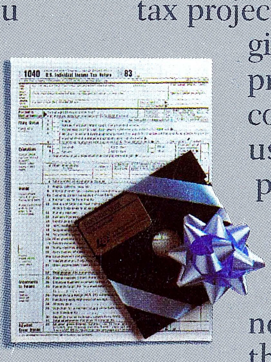


Many happy returns.



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February 1984